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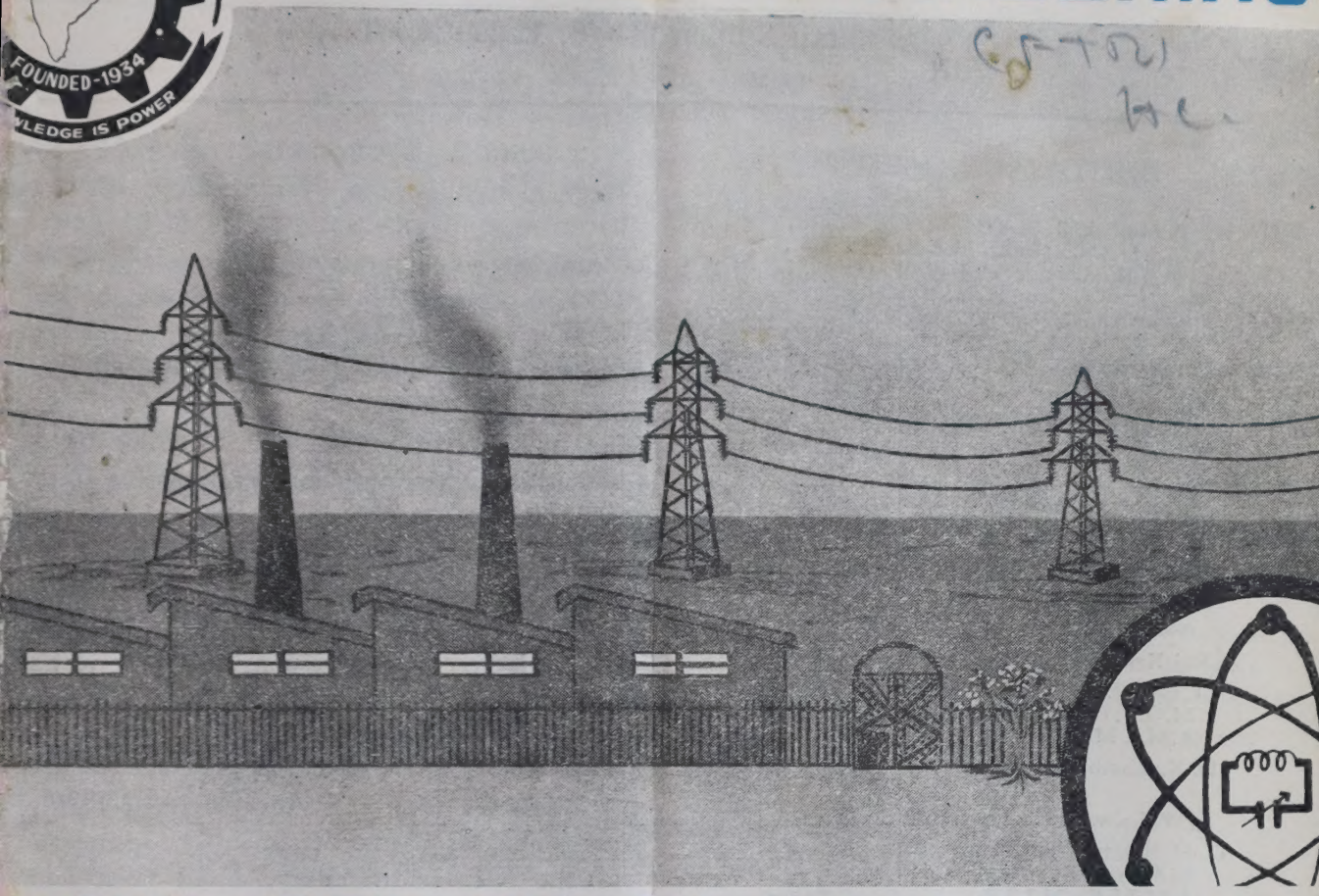

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SCIENCE & ENGINEERING

MARCH 1972

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AMINO ACIDS AND EVOLUTION OF LIFE

The beginnings of evolution of life has been slowest to come to light and the most difficult to know, but some startling discoveries about a primitive photosynthetic protein may help uncover the well hidden roots of the tree of life.

A team of chemists at the San Diego Campus of the University of California, Drs. Karl Dus, Knut Sletten and Martin D. Kamen have shown that Cytochrome c proteins present in all living things derive from the same ancestral gene. They have shown that there are obvious structural similarities in the primary sequence of this small respiratory enzyme as it appears in the plant bacteria Rhodospirillum rubrum, in man and in other mammals.

To understand the evolutionary relationship between apparent dissimilar species as varied as Hippopotamus and moth, tuna fish and shaft of wheat—it is no longer considered the exclusive concern of fossil fragment providing gross geological data about the subtle changes occuring amongst earth's organisms over billions of years. The biochemists now compare between similar molecules from different species in order to discover how closely the species are related. From such information they attempt to extrapolate, in order to form a picture of the earlier patterns from which the contemporary relationships have emerged.

Many genes are common to almost all organisms, and theoretically these universal genes each derive from a single ancestor. The phylogenetic tree of species has been formed by mistakes on mutations in the gene copying process. Most of these never pass the test of adaptability to the environment. Those few that are retained, in turn give rise to other mistakes or mutations, and to new organisms.

Mutation generally occurs at a constant rate (like beta decay)—about one for every hundred thousand gene replications. Hence comparison of common genes is a reliable indicator of relationships between species. Divergence far back in evolutionary history is indicated by large structural differences in common genes. If common genes of different species have very similar structures, the two species have diverged recently.

Although biochemists would like to compare gene structures, this is almost impossible as only one very small gene has had its sequence of nucleotides worked out. No doubt more informations on RNA and DNA are recently coming in. However the boichemists turn to enzyme proteins, the molecules which act as chemical catalysts to carry out the gene's instructions. These proteins express gene mutations by changes in their amino acid structures, and are far easier to study. The protein that biochemists have studied most is cytochrome c. This small respiratory enzyme is only 110 amino acid residue long and can be easily extracted from biological materials. Over 30 cytochrome c molecules have had their amino acid sequences worked out in organisms ranging from man, through the hippopotamus, finback whale, pekin duck, snapping turtle, ratile snake to baker's yeast and the bacterium Pseudomonas fluorens. Thus a definite tree of life, it has been possible to construct by comparison of these sequences. However Pseudomonas fluorens, the most ancient of these organisms, is so unlike the others, that relationship between them still remains obscure, and the earliest branches of the tree are still a mystery.

The San Diego team has had under study for five years Rhodospirillum rubrum, the primitive photosynthetic bacteria, and Drs. Dus, Sletten and Kamen announced that they worked out the amino acid structure of the bacteria's cytochrome c_2 by chemical fragmentation in the laboratory, and had thus been able to bridge the enormous evolutionary gulf separating mammals from primitive organisms.

According to these biochemists R. rubrum is clearly related to the highest form of life, that cytochrome c_2 of this photosynthetic organism is older than cytochrome c of the mammalian species, and due to the high content of homologous sequences, is even older than cytochrome c of P. fluorescens, which could have evolved from it by deletion of certain parts of the message, as reported in the Journal of Biological Chemistry, Oct. 25, 1968.

Although some gaps remain in the chain of life, the San Diego group think that it may be possible to work out in detail how the principal phyla evolved from the informations now available, though a complete comparison between cytochrome c_2 and mammalian cytochrome c cannot be made without invoking certain gaps or deletions. It is impossible to decide at present whether these gaps reflect deflections in the genome of the mammalian species, or whether they represent portions of the genetic materials added to genome of R. rubrum in order to adopt the cytochrome c_2 for photosynthetic electron transfer. The significance of these structural features is expected to emerge from further comparative sequence studies of these proteins.

Recent studies of peptides produced by micro-organisms, suggest protein evolution from the small catalytically active peptides. The peptides represent biological antiques from an early stage in evolution. Such antibiotic peptides as gramicidin, staphylomycins, and penicillins are synthesised differently from polypeptides, according to Dr. M. Bodanszky, Professor of Chemistry of Cleveland's Case Western Reserve University and Dr. D.

Perlman, Professor of Biochemistry at University of Wisconsin. According to them, these antibiotic peptides appear to be assembled by a simple enzyme system rather than by messenger—RNA and ribosomes. The true role of peptide antibiotics in the life process of the producing cell is however still unknown. If the functionality of microbal peptides is accepted, then it follows directly that they evolved at a period when the principle of L—amino acids had already been established, but the production of proteins (vis nucleic acid coded synthesis on the ribosomes) had not yet been realised (Peptide antibiotics, Science, Jany. 24, 1969).

The San Diego group is however seeking the original small peptide from which R. rubrum cytochrome c_2 evolved. They consider that with the help of sophisticated computer programs, it may be possible to discover the length and amino-acid sequences of this ancient biological catalyst crucial to the beginnings of nearly all life on earth.

According to the researchers, the primary sequence of R. rubrum cytochrome c_2 consists of repeating units, 13 to 20 amino-acids long including the site at which the catalytic activity of the molecule is located. Current theory holds that life began on earth with amino-acids formed from various combinations of primordial gases. Synthesised by such energy sources as electrical discharge, ultraviolet rdiations, and even visible light (In the beginning, the Sciences, Nov. 1968). They claim that combinations of amino acids again gave rise to small peptides, biological catalysts whose code is carried by small, simple genes. A common mistake of a gene is doubling, making two copies of a gene rather than one. Instead of separating, these two gene copies may form a single unit twice as long as the original, which in turn would code for proteins double in length of their ancestors. The San Diego team have suggested that the R. rubrum cytochrome c_2 repeating units arose from peptides via the mechanism of gene doubling.

[redacted]

LIFE IN SPACE

By

U. P. MULLICK, (M)

In 1953 amino acids were synthesised from a gaseous atmosphere of methane, ammonia, hydrogen and water. Biochemists then theorized that the first living organism on earth could certainly have been born from these life making gases.

There was however the question, where did these gases come from ? Two teams of astrophysicists have apparently answered this question with some precision. Of the gases regarded as necessary precursors of life, only hydrogen was previously found in space. However during 1969, radio telescopes have also reported presence of ammonia and water, and most recently formaldehyde.

All these life making gases have been detected in the inter-steller dust clouds, in the cool regions of the galaxy, where new solar systems are believed to be forming. This can be considered as one of the greatest scientific discoveries of the age.

Formaldehyde, a close chemical cousin of methane, is chemically partially oxided methyl alcohol. Its presence in space strongly indicates simultaneous presence of methane, completing the list of life forming chemicals.

Methane, however, cannot be detected with radio telescopes, which have been used since 1951 to detect intersteller gases. When gas electrons drop from high to low energy levels, they are known to emit electro-magnetic radiations that can range from short wave ultraviolet light through optical light to radio signals. Radar technology developed since World War II permits detection of these radiation lines, and identification of the gases uniquely associate with them. However methane's molecular structure does not produce a clearly discernible characteristic line.

Hydrogen was found widely distributed throughout space in 1951. Physicists therefore sought for other radio lines emitted by other elements or molecules. In 1957 Nobelist Dr. Charles Townes, later of the University of California, succeeded in identifying lines of radiation for exploration, but no other substance was discovered till 1963. In 1963 a group from Massachusetts Institute of Technology detected hydroxyl, the first intersteller molecule. Ammonia (NH_3) was found late in 1968 by Dr. Townes and his Berkely colleagues, reported in 'The Gas of Genesis,' the Sciences, (April 1969). The same group successfully located also eight sources of intersteller water, a few months later. They identified non-illuminated clouds of hydroxyl and water, and containing the gas formaldahyde (March 31, 1969).

This latest and most complex molecule, namely formaldehyde, H_2CO, two atoms of hydrogen and one atom of oxygen bonded to carbon was also detected in as many as 15 dust clouds by a group at the National Radio Astronomy Observatory in Green Banks, West Virginia. At least some of the observed features appeared to originate in typical intersteller clouds, some of which are associated

vith spiral arms of nebulas. Other features, ne scientists consider, appear to be physically elated to the continuum sources they absorb. Hence it is considered that the molecule H_2CO is widely distributed throughout the galaxy. The paper jointly by Lewie Snyder, David Buhl, Benjamin Zuckerman and Patrick Palmer entitled, 'Microwave Detection of Interstriller Formaldehyde'[2] Physical Review Letters March 31, 1969, is interesting.

The detection of formaldehyde, however, has invariably been made in hydroxyl clouds and in clouds of water only, but not in clouds with ammonia. However the NRAO team believes that all the four gases will eventually be found together. They suggest that the process of intersteller chemical evolution may be much more complex than previously assumed. Thus though formaldehyde is associated with methane, it is also a byproduct of amino-acids breakdown in some organisms on earth. This raises the possibility that amino-acids are present in space gas clouds. However steller radiation is considered too intense for formation of such complex molecules, but the presence of ammonia, water and formaldehyde in space gases is strong evidence that the clouds' interiors are relatively stable, and amino-acids may exist there.

A point to consider, however, is that amino-acids from breakdown of earth organisms have a left handed symmetry, and perhaps the origin of left handedness in organic molecules. Thus the presence of amino acids in a region of space where new planetary systems are being created, may partially explain the formation of life on earth.

Great importance, however, has been laid on the discovery of formaldehyde in space. The most recent informations about presence of formaldehyde in space may hold the key to explain the origin of the Universe. Scientist have discovered in Crab Nebula gas clouds of hydrogen, water, ammonia and formaldehyde. Dark spaces of other nebulas examined are Ring Nebula in Lyra, Nebula in Scutum Sobieski, Horsehead Nebula in Orion, Great Nebula in Orion, Trifid Nebula in Sagittarius, and Cone nebula in Monoceros.

The NRAO astronomers announced in the June issue of Astrophysical Journal letters[3] that they have found formaldehyde as an *absorption line in several cold dark clouds of hydrogen, hydroxyl and dust off the galactic plane.*

Just as some faint diffused light is necessary to detect objects on a moonless light, so also there must be back ground radiations present in order to detect an absorption line. There is no apparant light source to provide such radiation behind the newly discoverd formaldehyde. The NRAO astronomer have therefore suggested that the background radiation may therefore be a remnant of the primeval fireball—or Big Bang that many physicists believe started the Universe.

This radiation is presumed to be 3 degree Kelvin. NRAO scientists speculate that the formaldehyde molecules, which radiate at the 4830 Megahertz frequency. have a radiation below 3 degree kelvin, and create an absorption line when they absorb energy from the fireball's radiation.

In my 'Unified Theory on the Universe'[4] (published June 1965) (reviewed in USSR Academy of Sciences Review dated January 1967), I have postulated an ellypsoidal shape for the space continuum in place of Dr. Einstein's spherical continuum. Also instead

of the Big Bang theory advocated by some of the scientists, I have postulated a two way stable flow oscillatory theory of the cosmos over the ellypsoidal continuum. The two polar regions (Regions 1 and 16) are regions of maximum potential energy, and areas of highest temperature and pressure, due to maximum collision effect in the contracted space continuum of the region. The Regions are also areas of disintegration of atoms, and resynthesis of the heavest atoms. The intermediate regions (Regions 2, 3. 4, 5, and 15, 14, 13, 12 in the opposite hemisphere) are sucessively Regions of atomic crystallisation or atomic growth (the heavier atoms synthesising first in order of theirs atomic weights, and lighter atoms synthesising in more distant regions from the poles, under diminishing temperature and pressure with the expanding in continuum. Regions of Nebular Origin, Regions of Quasi-steller Nebular formation, and Regions of Nebular Growth respectively.

Regions 6 and 11 are Regions of ageing and starry nebulas with starry galaxies. Our Solar system, galaxy and Nebula, in my view, being possibly in Region 6 in the left hemisphere, is gradually appraching the equator of the continuum for ultimate disintegration. Regions 7 and 10 are Regions of invisible, cold and fast moving dying nebulas, and Regions 8 and 9 (on either sides of the equator) are regions of nebular implosion and explosion and fragmentation of matter.

It is thus possible that nebulas and galaxies in Region 6 (region of our solar system) moving towards equator on the left hemisphere, will be surrounded by debris and dark clouds dust flowing in opposite direction from the exploded fragments of Region 9. The cold dust will be flowing past through the intersteller spaces of the galaxies (in Region 6, and 11), and due to the gravitational pull of the galaxies, will be partly drawn towards the heart of the galaxies, partly drawn towards the spiral arms of the ageing nebulas, and partly consolidated and synthesised into new star formations in the cold dust cloud in intersteller regions. A vice versa effect will take place in Region 11 also in the opposite hemisphere, but with flow of dust clouds from fragmentation from Region 8. Thus these are likely to be anti-matter of an anti-universe (comprising Regions 9 to 16), and will act like isomers. Left handed symmetry in Regions 6, 7, 8 will be right handed symmetry in Regions 11, 10, 9.

The debris thrown up in the bank of dark, cold clouds in Regions 8 and 9 due to explosion and implosion on exceeding the Chandrasekhar a limit, will contain debris and disintegration of life matter also in form of gases of hydrogen, water, hydroxyl, ammonia, methane, amino-acids, and byproduct formaldehyde, and these will float past through Regions 6 and 11 (regions of ageings stars and nebulas—region of our solar system and galaxy), and will be detected in the cold dark dust clouds in the intersteller spaces of the galaxies of our nebular region, and in our own galaxy.

The radiation drops to 3 degree Kelvin, even to less in the intersteller spaces in Regions 6 and 7 and, 10 and 11, and to zero degree Kelvin near the continuum equator.

It has been observed that in all living systems, when polarised light is passed through an organic amino-acid solution in our solar system (Region 6), its plane is rotated to the left. It is possible that in terms of the two way stable flow oscillatory theory

with simultaneous radiation flow and matter flow in opposite directions from the two poles of the continuum, if polarised light can be passed through the amino-acid in Regions 9, 10, 11, its plane will be found to be rotated to the right, with a right handed symmetry. Laboratory synthesised amino-acids have right handed as well as left handed symmetry.

Thus the latest discovery of fomaldehyde in dark cold clouds containing hydrogen, hydroxyl, and water and dust off the galactic plane (in Region 6) in Nebulas like Crab Nebula, Horsehead Nebula in Orion. Great Nebula in Orion and in others tend to confirm and strengthen the two way stable flow oscillatory theory of the cosmos.

References

1. Dr. Townes C., and his Berkeley colleagues. The Gas of Genesis. The Sciences, April 1969.

2. Snyder L.E., Buhl D., Zuckerman B., Palmer P., Microwave Detection of Intersteller Formaldehyde. Physical Review Letters, March 31, 1969.

3. Snyder L E., Buhl D., Zuckerman B., Palmer P., NRAO, Green Banks, West Virginia, Astrophysical Journal Letters, June 1969.

4. Mullick U.P., Unified Theory on the Universe. June 1965. pp. 28-34 (USSR Academy of Sciences Review January 1967)

5. The Sciences Vol 9 No. 8 Aug. 1959 pp. 16-20. New York Academy of Sciences, N.Y.

CIVIL ENGINEERING

A Challenging Profession

By

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Introduction

No country is so rich as to be able to waste its resources, human or natural. No country is so rich to be able to waste its engineering talent for indefinite length of time. We need plenty of civil engineer with capable technical background proper training and experience with respect to the various services of an urban and rural society, in both public and private enterprise careers.

The extent of useful knowledge required is so great today to meet the new challenges of civil engineering, that co-operative enbea-

vours of many highly skilled individuals must be combined into a multidisciplined effort to handle most projects effectively. A high degree of management skill is required.

The range of activities of a civil engineer is ever increasing and demanding. Opportunities are unlimited for capable engineers. This branch of engineering suffers the least from the present unemployment problem.

This paper discusses the challenges and roles of future civil engineers, and covers few suggestions to make them capable of handling the problems of the dynamic field of civil engineering, in both private and public sectors of economy.

Function of Civil Engineering

Engineering has long been regarded as "The profession in which knowledge of mathematical and natural sciences gained by study, experience and practice is applied with judgement to develop ways to utilise, economically, the material and forces of nature for well being of mankind". Civil Engineering is "primarily concerned with the control, adoptation and modification of marks physical environment in the interest of his comfort, health and efficiency". As a consequence civil engineering is mainly involved in activities which have the nature of public works.

Civil Engineering is largely public facility engineering. Nearly every thing which does not move and nearly every thing underground which can not be seen is the work of the Civil Engineering. Civil Engineering, in its applications differs from other type of engineering as it is primarily public oriented, whereas other branches of engineering are primarily privately oriented. Civil Engineers associated with buildings, bridges, railways, highways, airport, waterways, water resources and disposal etc., are mostly in Government services. The civil engineers who are in private sector, work, with industrial concerns, consulting firms, and contractors of heavy constructions.

Civil Engineering is the exercise of responsible practice at various levels in the area of civil works involving the selection and direction of men, responsibility for planning, financing, design, construction and operation of such works and systems. It unites and strengthens all specialities compresing the Civil Engineering.

Such functions of Civil Engineering require more than knowing slide-rules and computer, more than familiarity with theoretical analysis and more than the technical knowledge. The range of activities of a Civil Engineer in private and public sectors, both is ever increasing, demanding hardwork, technological excellence, management capability, good judgement and understanding.

Technological Developments

In the present day, there is increased emphasis on experimental research as contrasted with theoretical work. The continuous development of new techniques and materials such as plastics, ceramics etc , is likely to bring changing trends in Civil Engineering. The computers are now developed even for routine calculations, saving lot of engineering time for other creative work.

Technology and scientific knowledge will expand explosively in near future looking for the solutions of difficult, poorly defined real problems for which ready-made solutions will not be available. This applies not only to construction, but to all disciplines of Civil Engineering.

Employing firms and government agencies will expect that fresh Civil Engineering graduates should have sound back ground in behaviour of new materials. Those having weakness in the areas of creativity and Civil-Engineering knowledge, will find employers less responsive in coming decade than in the past.

Thoroughness of Knowledge

The thoroughness of knowledge is unquestionably desirable in Civil Engineering, as Civil Engineer is requires to verify each minute detail of each engineering project which is under his supervision. If his knowledge is thorough, he will recognise the difficulty and short comings and overcome them. If his knowledge is not perfect, he although may get selected for lower technical post, but the level of his achievement may prove entirely inadequate for broader responsibilities.

Demands of Urbanization

A new civil engineering activity is emerging in response to increasing demands of urbanisation. It concerns with the planning, design and management of a variety of urban services and facilities such as water supply, water disposal, transportation, housing etc. They are of major interest to civil engineers of today. The Engineer who works with the urban activities, requires additional skills different from those of the conventional civil engineer. New standards of professional competence are to be developed. Scientific knowledge from all relevant disciplines should be integrated into a new kind of civil engineering. His conventional engineering knowledge is useful, but not adequate for demands of urbanisation and environment. Civil Engineering profession has major opportunities in urban system engineering if the areas of responsibility are identified and accepted enthusiastically—perhaps the civil engineering of future.

Need for Managerial Qualities

It is rare to find the practising Civil Engineer who does not become involved in management problem even at an early stage of his career. As he advances in his profession, a typical engineer will have a decreasing personal involvement in the detailed execution of technical task, but becomes increasingly concerned with formulation of policies and management. His professional scope is widened and his immediate level of interests are shifted. He, without a deliberate choice, is forced to spend substantial portion of his time in performing managerial functions. Where broad managerial responsibilities are involved, the engineer must be able to recognise and utilise the pertinent interrelationship between multi-disciplinary activities which he directs.

Environmental Challenges

Environmental planning will become increasingly important to Civil Engineers in seventies. Environmental conditions and society needs have reached a stage, at the expense of the engineer's reputation where he can not think of a new project, without considering environmental impacts. The situation seen today has developed with astonishing rapidity. This rate of change in environment conditions and in the technology, which both creates and combats the problems to be faced—pollution, congestion, noise etc. will increase drastically in next two or three decades. The Civil Engineer has a special responsibility for the environment. In carrying out this responsibility the engineer of future will face a challenge, which will

demand a thorough knowledge of fundamentals, an ability to adopt to change, an unrestrained creative mind and decision making capability.

In environmental planning and design Civil Engineer works as a member of a design team with architects planners, economists, financiers, sociologists, lawyers and other specialists. Civil Engineering graduates must therefore be made aware of such inter disciplinary team work.

Modern Optimization Problems

Practising engineers are continually confronted with optimisation problems in which project values needs to identified as the criterion for evaluating alternative solutions. Optimisation requires the comparison of all feasible alternatives. Numerous alternatives should be included in the study, however and the aim should be to find the best. It is some times necessary to design these alternatives, because in many cases they are not things which are naturally available for comparison. In engineering method this design process is done through models. If an analog of the of the structure and behaviour of all the significant parts of the problems is available, then this model or theory is used to arrive at a design deductively, because the design is implicit in the model. A model whether a physical, conceptual or mathematical abstraction, is a device which behaves in a way that is ana-logous to the significant aspects of the problem.

Graduates in Engineering should have the skills needed to make them familiar with new methods and procedures which will be developed during the later years of their careers. Today's Engineer has at his disposal a new tool known as "Critical path method" which helps him in optimisation problems, and provides a management with rational basis for planning, scheduling, estimating and controlling construction projects.

Highway Safety Demands

Civil Engineers, as the professionals most involved in highway transportation, have a vital role to play in reducing the heavy and ever increasing traffic accident toll. The civil engineer has 3 different responsibilities. Part of his responsibilities are related to special skill as an engineer in design and construction of road. A second responsibility stems from his position as a civil engineer to protect the public health, safety and welfare. The third facet of the civil engineer's role is that of the scientist who must test not only his own, but other's efforts, by measured observations.

Civil Engineer who has distinguished himself in dealing with natural forces to meet requirements of service to human needs now bears a larger responsibility to participate actively in the guidance of the many non-engineering activities which affect traffic safety.

Conclusion

Both public and private sector of our economy need management by trained Civil Engineers, with a capable technical background. Most of the detailed knowledge acquired today will be out of date 5 or 10 years hence. Civil Engineering and its education must therefore be flexible, adoptable and progressive. A successful engineer should never stop educating himself, as the civil engineering profession is a dynamic one.

The extent of useful knowledge is so great today that co-operative endeavours of many highly skilled individuals must be combined into multi disciplined efforts to handle most

projects effectively. A high degree of capable management skill is required to solve a transportation problem within a sensible cost.

Capable engineers can not be produced unless capable students are attracted for civil engineering. If a student places emphasis on working 6-8 hours a day only, he should keep away from the profession as civil engineer. But if a young man enjoys competition, reveals satisfaction of a difficult job well done, feels a justifiable pride in viewing a completed project which he designed or constructed and can forget his personal problems for such achievements, he qualifies himself for the education to become civil engineer. Opportunities both in public and private sectors are unlimited. A capable man will pick up wide range of attractive distinction and positions in either of the two sectors of economy.

The characteristic and orientation of education programme should be responsive to the need of society. Experimentation is an essential element of an education system which would continually adopt to changing conditions and continually improve. Civil Engineering and its education must be flexible, adoptable and progressive to be responsive to the needs of society today and tomorrow. It should not be allowed to become static and should be subjected to constant review and revision.

EXAMINATION SYSTEM IN POLYTECHNIC EDUCATION IN WEST BENGAL

By

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Before entering into the discussion, the author likes to define the term 'Examination', In the field of education, the term 'Examination' may be defined as a process by which assessment of knowledge is made with due regard to proper judgement. Again, the assessment of knowledge is required to evaluate the individual merit and the ability of one to perform a certain job. So, if this be the object of examination, much care should be taken in assesment, so that the successful candidates may gainfully be employed to serve the country with their knowledge. If the examination system is a faulty one, we can not expect a good result from it, as it functions like a deformed and torn-out sieve.

In India, Polytechnic courses were introduced to prepare the manpower requirement of the industry without giving a serious thought to the actual needs of the country.

During the first and Second Five year-plan, technical personnels were absorbed in industries without much comments owing to the shortage of skilled technicians. The industrialists at present have become selective in their absorption of the technicians and various complaints regarding the quality of such technicians are made.

In the existing system of Polytechnic education in this state, the syllabus of each course is spread over the period of the course, with examinations at the end of each year. A class or division is awarded to the successful candidates at the end of the course considering the performance of the candidate in three hours on each subject, the examination being taken on a particular day fixed up by the State Council.

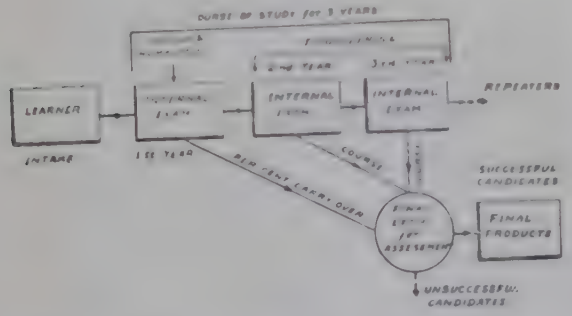

Diagram showing various stages of processing students throughout a duration period of three years in polytechnic course of study.

The question papers for the final examinations are usually set by the technical personnels taken from external sources and not from any polytechnic. The paper setters may not be persons of teaching profession even. Thus, the subject teacher is deprived of evaluating the merit of his students. It is fact that a teacher knows well about the performance of his students. The teachers are not even appointed as internal examiners to evaluate the merit of his students jointly with the external examiners. This is an injustice to the students as well as to the teachers of polytechincs.

One might have marked that the same question without any change in language and data even is repeated every year. As a result of this unrealistic and faulty system, cramming is induced in the students without gaining a thorough insight into the subject. The prevailing system of examination thus becomes a game of speculation and induces cramming and copying practice running parallel.

The students are to face eight papers covering ten to twelve subjets at a time at the end of the course along with practicals and a general viva-voce test. They become tired and fatigued due to heavy rush of arrears and tremendous strain in their brains.

The future of a student depends on three hours' test as it is the only and final evaluation. On finding no way out, they become desperate and tend to adopt unfair means. It is really a surprise that the knowledge of a student on a subject is evaluated in three hours only and that is the final evaluation on the basis of which the students are awarded certificates of ability to perform a job for the service to this country.

The syllabus of the course of study in polytechnic education is poorly defined. The limitations of each course are not well defined to the students and teachers of the polytechnics. One can easily find that there is a feeble link between the syllabus and the question papers set for final evaluation.

The day and date of examination fixed up by the examining authority for final

evaluation which is the only one evaluation may not suit to the health and mental condition of a student. This is another draw back of the prevailing system of examination.

The oral (Viva-Voce) tests on each subject are not made to evaluate the knowledge of the candidates. This is one more drawback of such examination system.

Practically no arrangement is made to corelate the theory and practice. The syllabus is not industrially oriented for which the course of study was meant. Selected broad questions set in final examination fail to estimate the depth of knowledge. The time allowed for each examination is too short. There is no arrangement to keep cumulative record card of individual students speaking of the performance of the student throughout the entire period of study. No importance is given to the internal assessment.

A block diagram showing various stages of processing students throughout a duration period of three years in polytechnic course of study is illustrated in Fig. I. The final products of polytechinc institutions thus remain half-baked without having thorough grinding in the principles and practice in engineering and technology. The wastage of brains, time, labour and money in the existing system of processing and evaluation in polytechnic education is now seriously felt by all. The unemployment problem also is gradually becoming acute.

The courses of study should thoroughly be changed and should be oriented in such a fashion that agriculture and cottage industries can grow rapidly side by side in our country. The unemployment problem of a country like India can never be solved by the heavy industries alone. Eighty per-cent stress should immediately be given to agriculture and cottage industries for which practically nothing has been done so far.

Students who are the future back-bones of our country should have the freedom of selecting their individual courses of study in which they are interested. Thus, a student will have a tendency to specialize himself in the subject of his own choice and interest. A student must not be over-burdened with more numbers of foreign subjects along with his subject of interest. It is a bad practice to compel one to learn ten to twelve broad subjects at a time and it is found that not a single subject is thoroughly studied by most of the students. In the present system of education, the students run after certificates only.

The cent per cent external assessment should immediately be discarded. The teachers only have the sole and justified right to judge the merit of their students. However, 20 per cent assessment may be done by the external examiners, if needed.

The semester system may gainfully be employed to relieve the burden of examination from the minds of the students and to make them work throughout the year without killing any time in case of failure of the students.

Cumulative record card should be kept for individual student to note the performance of the student throught-out the entire period of study.

The question should be practically oriented. Broad questions must not be set in any case. If needed, open book tests may be allowed as the memory power of students to

cram certain large size equations or formulas and complicated deductions need not be tested. Open book tests may be encouraged in as many subjects as possible. The technical students as engineers should know the effective use of reference books.

To test the thoroughness of a subject acquired by a student and his depth of knowledge, arrangements should be made for discussions and seminar lectures by students and oral examination in all the subjects, frequently. Assessment marks should also be alloted for manufactural work, creative thinking and modelling techniques.

The system of study and the method of assessment should be such that the agriculture, industries (heavy and cottage) and the Polytechnic institutions serve as complementary to each other. Lastly, the authour expects that the teachers and the students shall work honestly hand in hand in an ideal environment, free from dirty atmospheres keeping in view the interest of the country and devoting themselves fully to the cause of engineering and technology.

EARTHQUAKES

By

PREM SIKKA, M.Sc. (Anthropology)
University of Delhi, Delhi-7.

Hardly a passes when we do not come across the news of an earthquake which might have occured in one or the other part of the world. India is no exception to it. The memories of Bihar, Queta, Koyna etc. earthquakes, are still fresh in the fluorescent screen of many contemporary minds. The earthquakes of Gediz-a small town of Turkey, Japan (1923) and Kan Son China (1920) etc. have also left their marks in history.

Generally our earth experiences more than a lakh shocks, feeble and strong both, every year. Their origin lies at the depths ranging from 30 kms. to 700 kms. and more of the earth's surface. The effects of earthquakes are very disappointing. It induces fright besides death and destruction. Their most impressive characterstics is their unexpectedness. These can easily be felt and recognised from its various types of motion. It appears like a heavy vehicle passing by the side. Land slides surface cracking, seismic waves and sea wave, can be the immediate affects of earthquakes. Once on the Siberian Coast, a sea wave generated by an quake rose as high as 63 metres. Tsuenamis or Seasmic waves are the result of submarine earthquake. The earthquake is treated both as a tool for the investigations of the interior of the earth and as a menace that must be dealt with.

Lisbon in Portugal was hit by an earthquake of high intensity on November, 1755 at 9. 40 morning. Its source was situated some distance off the Coast. The main shock was felt for about six minutes. The total number of people killed alone were 60,000 including those who perished by drowning and in the fire that burned for six days following the shock. It is not possible to give the descriptions of great earthquakes, in the brief span of this article.

There is almost invariably or long series of shocks, after a great earthquake. Some are almost as strong as the first one while others are of diminishing intensities, which may last for months. These are generally the aftershocks of the main earthquake rather than the independent earthquakes. Some time foreshocks are also experienced. It is said that even if we come to know that the earthquake forces are at work, it is not possible to say that when they will come to action.

The Causes of Earthquakes

People had funny views, in ancient times about earthquakes. Indian felt that the earth is rested on the hood of a divine serpent, and any shifting of the hood results in earthquake. It was a giant tortoise, thought North American Indians. The Mangolians believe that the earth is rested on the hog.

The first scientific explanation for its cause was given by Aristotle—a Greek Philosopher. He said that because of the warmth of the inner surface of earth, the gases enclosed in the bowels of the earth, expands and try to escape, which results in earthquake. Ultimate cause of earthquakes has not yet been established but following various scientific view, have been expressed from time to time.

1. Due to the conviction of the molten materials between the inner hot surface and outer cold surface of the earth's crust. It is the erruptions of volcanos on land or on the sea level.

2. Growing of the continents by the accretion of material acquired from below by physical or chemical differentiation and that growth is greatest at the margins. The contents being, of lower density than the surrounding medium, float in it. As a result of this, the material is added to their undersides and distributed equally.

3. Rain and rivers flow the sediments along with them and deposit it in the sea bed ; which disturbes the mass distribution of the earth.

4. Shrinking of the earth's crust, Iso-static readjustment, plastic currents in the mantle below the earth's crust and radio active heating effects also figured for its cause. Radio-activity of certain rocks is due to the presence of radium bearing minerals. The heat continously given off by the radium cannot escape from within the crust, which in turn melts the interior.

5. A reasonably satisfactory explanation has been given by Elastic rebound theory. Elastic strains are set up by the differential movement in the outer layer of the earth ; along a plane of weakness, called *fault*. The elastic waves are produced by the rubbing together of two faults. Also whenever a change occurs in the state of strain or distortion of a limited portion of the earth, elastic waves are set up, which travel outwards in all directions. Movement of a fault can also be due to the slow accumulation of strain in the rocks over a considerable region until they fail and rupture.

Earthquake waves have been analysed from the seismo-metric data into (i) P-primary waves which are compressional and longitudinal, S-secondary waves which are distortional and transverse and, L-long waves which travel fast through the earth and causes foreshock. The earthquake wave is also a powerful tool for the investigation of the deep interior of the earth, even to its centre, which can be penetrated in no other way. Violent shocks of the quake are caused by the surface waves. Teleseismic work is of importance in telling us about earthquake wave transmission and the interior of earth as well as locating the point of origin of earthquakes. Certain portions of the earth's crust are more subject to earthquakes than others. The two zones of the earthquake belt are (1) a line or belt through the Mediterranean, Asia Minor, the Himalayas and the East Indies ; and (2) Western, Eastern and Northern shores of the Pacific. In India, this belt is along Himalayas and it extends to the South-West upto Rann of Kutch. The city of Peru now in news, is also situated on the earthquake belt.

Earthquakes are very frequent in Japan. It will not be out of place to say that some time Japan has experienced about a hundred shock a day. In Japan, houses are built with light bamboo and with thatched or other light roofs, as they would suffer little damage. However, in many cases, heavy tile roofs are used so that in an earthquake the building resembles an inverted pendulum. The tiles soon began to fall on those within certain types of pagodas (houses) have survived earthquake in China and Japan. Earthquakes of endless variety but of the same family afford ample scope for their investigations. A challenge is regularly renewed as they bring each year losses of death and destruction to some part of the earth. Earthquakes are classified in three depth ranges of shallow, intermediate and deep. Tectonic Volcanic and Plutonic are two types of earthquakes.

Always disastrous, it has proned blessing in disguise when it came in Mexico on 9th Feb. 1956. A new source of sweet water was the out-come at a time, when there was a scarcity of drinking water.

Intensity and magnitude of an earthquake are the two main points for its study. A given earthquake has only one magnitude while its intensity is different at different places ; because of its dependence on the geological foundations, the distance from the source and the nature of the source.

A Seismograph records the magnitude of the ground motion of an earthquake. Frequency based instruments like Richter Magnitude scale, the Rossi Ford scale, or the Modified Mercalli intensity scale, are employed for measuring the intensity of an earthquake.

We are living in the age of science. Our knowledge about heavens above. Earth beneath and ocean under the earth has expanded much. No doubt, we are to learn much about the outer space but the study of the interior of the earth is not in any way less facinatings. Our concentration on the outer space has made earth an insignificant speck in space. Less progress has been made in the case of earthquakes than in other fields.

Discussions on the forcasting and predicting of earthquake are going on at the International level in America under U. N. Schemes. Due to the growth of population day by day,

calamities due to earthquake will be more and more, and as such it is sooner the better, if we can get all about earthquakes, in first hand. Science has made forecasting, predicting of the earthquake and recording of the "wobbling" of the earth when it rotates, distort or tilt etc., possible now. Scientists are busy now in studying the ways to control and prevent the earthquake. So long as the changes in the interior of earth will continue, it seems difficult at the first sight to control earthquakes. But if it is achieved, the earth will become still a safer place to live on.

SONIC BOOMS

Their effects on structures

By

NIRVAN R. VYAS (Non-Member)

Lecturer in Applied Mechanics Dept. of Applied Mechanics

S. K. J. Polytechnic, BROACH

An explosive like sound heard when an aircraft in the vicinity of an observer maneuvers at supersonic speed. Its characteristics vary according to situation. Some times they hear only one bang, observers report most often, hearing two bangs in quick succession. Actual sonic bangs are caused by the arrival at the observer of aircraft induced shock wave. The shockwaves produced in various Rinds of explosion are similar to the standing shocks that accompany a supersonic vehicle. In fact when an ordinary or an atomic bomb goes off, its material moves outwards at a very high supersonic speed. This leads to formation of a discontinuity of pressure in the surrounding medium which immediately precedes the expanding material of the exploded bombs But where a as supersonic vehicle proceeds with a constant speed, the hot gases formed in a bombs explosion lose their power and slow down as their volume increases. Under these circumstances, the shock wave seperated from the expanding hot gas sphere and travels through surrounding medium causing damage to any objects it encounter on its way.

It is the underwater shock-wave produced by depth charges that disables enemy submarines, it is the shockwave of an A-bombs that flattens buildings as if they were constructed of playing cards and it was the shockwave of the H-bomb explosion at Emitwetork that turned the Caral Island Elugelab into a pool of water a mile wide and 175 ft. deep. We are now all too familiar with the noises made by aircraft "breaking the sound barrier" not to mention these unfortunate people who have suffered damage to property as a result. These so called sonic bangs are of course caused by shock-waves generated by an aircraft

A sonic boom is a pressure wave, not dissimilar to that produced by a clap of themder which sweeps along the ground in the wake of the aircraft, despite the great atitude at which the aircraft is flying. A limit of *six* kg/mt^2 to *nine* kg per square meter has been established by the Federal avaiation Agency for the tolerable sonic boom pressure level at ground level.

Generally a structure may be effected by loading, wind, temperature, earthquakes, and subsidence due to mining or other causes, must now be added the effect of sonic booms. 'Symposium on effects of sonic booms on buildings' was the part of the annual meeting of the American Society for testing and materials held in Chicago in 1964. Happily the conclusion arrived at was that the operation of supersonic aircraft is not likely to necessiate any change in good building practice nor conversely is the development of supersonic transport likely to be hampered by the probable effects of sonic booms on soundly constructed buildings. As was pointed out at the symposium, pressures of such low intensities are relatively unimportant when compared with the wind pressure for which buildings are designed to resist. The results of test indicate that stresses caused by sonic booms pressures due to aircraft operating under controlled conditions are very small and are comparable to the stresses produced by a clap of thounder.

It is however the duty of structural Engineers and Architects to ensure that under anticipated working conditions, the structural and subsidiary materials in a building and their connections are not subjected to stresses so near the ultimate that the addition of a pressure of an intensity of a few kg. should cause failure.

Reference

(i) T. Gold. The double band of supersonic aircraft—Nature 170 (4332) 808 1952

(ii) Mecbanics of fight—A. C. Kermode.

(iii) Physics by Gamon & Cleaveland.

(iv) Concrete & Constructional Engineering Oct. '64.

COLD STORAGE DESIGN

Central Building Research Institute, Roorkee

A cold storage, as the name implies, is a place for storing commodities at the required low temperature. Correct design of the thermal insulation system contributes to the efficient and economic operation of the cold storage space. The cold storage capacity is normally specified in terms of the volume of the storage space. The size of storage chamber depends upon the total quantity of the product to be stored, the method of packing and clear space provided for movements. Central Building Research Institute, Roorke has worked on the problem of cold storage design and following recommendations are made (especially for potato cold storage).

(1) A storage space of 3.4 cubic meter/

ton is most suitable for proper stacking and circulation of cold air.

(2) The height of chamber should be from 5 to 10 meters for equal distribution and proper circulation of cold air.

(3) Passage between the rows of racks should not be less than 75 cm.

(4) The racks should be 20 to 25 cm. away from the walls.

(5) At least a gap of 30 cm should be provided between the ceiling and top of material.

Floor area of Potato Cold Storage for various heights is given in table 1.

TABLE 1.

Capacity of the Cold Storage for Different Heights of the Potato Cold Storage

Floor Area (m²)	Quantity of product to be stored (tons)			
	Height of the room (meters)			
	4	6	8	10
50	64	96	128	160
100	128	192	256	320
150	192	288	384	480
200	256	384	512	640
250	320	480	640	800
300	384	576	768	960
350	448	672	896	1120
400	512	768	1014	1280
450	576	864	1142	1440
500	640	960	1270	1600

Recommended minimum thicknesses of insulation (potato cold storage) are given in the Table 2.

TABLE 2.

Recommended minimum thickness of insulation for Potato Cold Store Building Section.

Sl. No.	Insulating material	Density (Kg/m²)	Thickness (cm)		
			Roof	Wall	Floor
1.	Cork	164.0	8.0	7.0	5 0
2.	Fibre Glass	26.5	7.5	7.0	5 0
3.	Expanded polyestrene	18.4	7.0	7.0	5.0
4.	Mineral wool	72.5	7.5	7.0	5.0
5.	Foam concrete	320.0	18.0	15.0	10.0
6.	Saw dust and rice husk	150.0	25.0	20.0	15.0

A slow speed compressor is better suited to our climatic conditions. The estimated refrigeration plant capacity is given in Table 3.

TABLE 3.

Design Specification for Cold Storages of Different Capacity

Quantity of potato to be stored (tons)	Height of the chamber (meter)	Floor area (m²)	No. of Rooms	Estimated Refrigeration capacity (tons)
1.500	6	283	1	13.5
	10	170	1	12.5
2.1000	6	566	2	25.0
	10	340	1	23.0
3.2000	6	1132	4	48.0
	10	680	2	45.0

NOTE TO READERS

Under some inordinate circumstances, SCIENCE & ENGINEERING for January & February 1972 could not be brought out. To compensate the lapse, additional textual has been provided in this and subsequent issues.

Book Review

ENGINEERING DRAWING, by Ghosh, D. N., Civil Engineering Department. Don Bosco Polytechnic, Calcutta. Revised and Enlarged Edition, 1971. Publisher : Dhanpat Rai & Sons, 1683 Nai Sarak, Delhi-6. $9\frac{3}{4}" \times 7\frac{1}{4}"$ Hard Cover. Illus. pp 604, Price Rs. 18.00 (Inland) 20 sh (Foreign). (First Pub. Oct. 1964, 2nd Ed. July 1967).

The volume is very comprehensive, and will assists the readers with every detail of Engineering Drawing, for clear conceptions, additional views. pictorial views, photographs and a large number of drawing plates have been added to the volume. The book covers the New Syllabus for the Engineering Drawing Paper of Associate Membership Examination (AMIE Section A) of the Institution of Engineers (India).

The book is covered by 21 Chapters, Chapter 1 on Engineering Drawing Chapter 2 on Drawing Instrument and their uses. Chapter 3 on lines Drawing and Lettering Styles, Chapter 4 on Layout and Dimensioning, Chapter 5 on Construction of Scales, Chapter 6 on Tracing of Curves, Chapter 7 on Engineering Graphs and and Charts Circuit Diagrams, Map and Layout, Shades and Shadings, Chapter 8 on Abbreviations, Symbols and Conventions, Chapter 9 on Projectional Drawings, Chapter 10 on Section of Solids, Chapter 11 on Intersection of Surfaces and Interpenetration of Solids, Chapter 12 on Development of Solid Surface, Chapter 13 on Perspective Drawing, Chapter 14 on Isometric and Colique Views, Chapter 15 on Glossary of Shop Terms and Free hand Sketching, Chapter 16 on Machine Components, Chapter 17 on Machine Drawing, Chapter 18 on Construction of Arches, Chapter 19 on Joints and Joinery Works in Timber, Chapter 20 on Bonds, in Brickwork, Chapter 21 on Building Drawing.

The book fills a great need for Engineering Students, and will be great help to make drawings internationally understandable, prepared according to the conventions and principles accepted universally, and will enable the drawing of an object to become a document of the same.

While the book deals exhaustively with civil and mechanical drawings, it will be worthwhile extending it to also electrical drawings. *U.P.M.*

Notes & News

Ajanta Sara Yantra. A mechanism for dividing fields into narrow irrigation beds with raised parallel ridges on either side.

Uniform irrigation of fields is important for obtaining good crop yields and for proper utilisation of water. For this purpose the field is levelled uniformly and divided into small beds with raised ridges or *saras* to hold the water. Water to these beds is fed through inter-field channels. This arrangement is useful for medium irrigation purposes

and is especially resorted to for crops like jowar, wheat, pulses, onion, garlic and other leafy vegetables.

Indian farmers make *saras* either manually with the help of wooden *phawada* and tooth-rake or by means of a harrow hitched to a pair of bullocks. Both these methods are time consuming, laborious and costly, and the *saras* made are of inferior quality in respect of level of bed, shape and size of the ridges, and spreading pattern of water.

Shri B. K. Dhonde of Ajanta Farm Machinery Co., Poona has developed a simple labour-saving device—Ajanta Sara Yantra—which renders *sara* making an easy, quick and less costly job ; at the same time, it gives *saras* of superior quality with even-surfaced irrigation beds which ensure equitable distribution and economy of water. In view of the ingenuity displayed, the Inventions Promotion Board has awarded Rs 500 to the inventor.

Ajanta Sara Yantra is made entirely of steel and all its parts are fixed in such a way that damaged parts can be easily replaced. It can be easily assembled and dis-assembled and, therefore, conveniently transported.

The main body of the device consists of two 6fytx 10½ in. plane black steel sheets of 10 gauge thickness. These sheets are held in position by a mild-steel frame at rear end over which a handle is mounted. At the front side the sheets are held together by a beam made of mild-steel angle iron.

The operation of the device is easy and does not require special skill. It is hitched to the bullocks' yoke by means of a rope. Its iron-plough like handle helps in easy turning and adjustment of the amount of soil to be scraped. The size of the ridge can be adjusted by keeping weight on the implement, by lifting or pressing the handle, or by hitching the bullocks nearer or away from the implement. The yantra can also be hitched to a tractor, for which a special frame is provided.

New Cotton Harvester for Improved Cultivation Technique. A cotton harvester being developed by the Mechanical Engineering Division of CSIRO, Australia will have three times more capacity than the conventional harvester.

The new machine is especially suited to harvesting cotton planted in 7-inch rows as against the conventional 40-inch row cultivation for which a spindle picker harvester is used. The new cultivation technique—broadcast cotton—has the advantages of a greater plant population, a shorter growing season, more even maturity and higher yields. The conventional spindle picker is unsuitable for harvesting broadcast cotton, being expensive and complicated and having a relatively low harvesting capacity.

The prototype harvester is powered by an 86 h.p. diesel engine with hydrostatic transmission ; the main driving power is provided by hydrostatic motors in each of the main driving wheels, giving steplessly variable speeds forwards and backwards. The 12½ ft wide stripping head has 96 steel fingers which strip off all the bolls. After a rotating kicker removes the bolls from the fingers, they are passed to a higher-speed shaft with rubber paddles which push them into a tapering duct; here, the mature bolls are carried by an air stream to the pre cleaner while the green bolls are discarded. A good amount of trash and dust is blown out through grids at the top of the dust, while the pre-cleaner removes the rest. The cotton is then conveyed to a secondary beater which transfers it to a vertical duct from where it is blown to the basket on the back of the harvester.

SOCIETY NOTES

ISE IN NATIONAL EMERGENCY

Text of letter No. EC(II)/71 3023 B) dated 15 12.71 from Shri Raj Krishna Banerjea, ISE General Secretary to the Secretary, Union Ministry of Industrial Development & Internal Trade, under copy to the Prime Minister & to the Secretaries, Ministry of Iron & Steel, Ministry of Irrigation & Power, Ministry of Transport & Communication, Government of India, New Delhi.

"This registered Society with over 3,500 members spread all over India and abroad, has in its last Executive Committee meeting dated 11.12.1971 taken note of the United States Government's decision to cut off all economic aid to India for simple fault that India is supporting the cause of democracy and restoration of democracy in Bangla Desh.

As a result of the cutting of American Economic Aid, India will be seriously affected in the near future as regards import of essential capital goods and maintenance equipments, not manufactured in India. Immediate import substitution is therefore necessary with reference to the class of goods that India had been importing from U.S.A.

This Society offers to Government of India all out technical assistance in the working out of alternative substitutes of imports to minimise or eleminate the effect of USA aid cut off.

The Society therefore requests your Ministry and the other Ministries so affected, to let the Society have a list of goods whose imports are likely to be affected by the cutting off of U.S. Economic aid, and whose import substitutes are urgently necessary. The members of the Society can then effectively try to tackle this vital problem, and render all assistance to Government of India and the country in this regards."

No. TW-20(2)/72
GOVERNMENT OF INDIA
Ministry of Steel & Mines
(Department of Steel)
New Delhi, dated 29th January, 1972.

To

1. The Chair Man, HSL, Ranchi.
2. The Managing Director, Mysore Iron & Steel Ltd., Bhadravati.
3. The General Manager, IISCO, Burnpur, Calcutta.
4. The General Manager, TISCO, Jamshedpur.

Subject : Import substitution of capital goods and spare parts.

Dear Sir,

Enclosed please find a copy of letter No. EC(II)/71-3023(B) Dated 15th December, 1971 from Messrs India Society of Engineers, 12-B, Netaji Subhas Road, Calcutta-1 for information.

Yours faithfully,
Sd/-
(K. S. Gulati)
Asstt. Development Officer.

Encl : Copy of letter.

Copy to :-

Shri R K. Banerjea, General Secretary, India Society of Engineers, Calcutta-1, with ref. to his letter referred to above

Sd/- K.S. Gulati
Asstt. Development Officer.

Text of Letter No. EC(II)/71 dated 15-12-71 from Shri Raj Krishna Banerjea, ISE General Secretary to the Union Ministry of Education & Youth Services under copies to the Prime Minister, to the Secretaries, Ministry of Industrial Development and Internal Trade, Ministry of Irrigation & Power, Ministry of Iron & Steel, Ministry of Works & Housing, Ministry of Transport & Communication, and to the High Commissioner for the People's Republic of Bangla Desh.

The Society with over 3,500 members spread all over India and abroad has in its last Executive Committee meeting dated 11. 12. 71, set up an Aid Bangla Desh Committee for rendering technical and industrial assistance to Bangla Desh channalised through Government of India.

The Society can render technical services through its members in civil, electrical. mechanical and chemical and metallurgical engineering, in setting up of light industries, medium industries and heavy industry. The Society can give special assistance to Bangla Desh, in :-

(i) Low cost housing for rehabilitation purposes.
(ii) Reconstruction of transport system and major and minor bridges.
(iii) Rural Industrialisation.
(iv) In Rural Electrification, Transmission & Power Supply.
(v) Short term training courses in skilled and semi-skilled trades.
(vi) Manufacture of small engineering goods.
(vii) Textile, foundry, non-ferrous and iron & steel, re-rolling, mini-steel plants, light petrochemicals and fertilisers.

We invite Government of India's attention for utilisation of the services offered in promotion of economic prosperity of Bangla Desh.

GOVERNMENT OF INDIA
Ministry of External Affairs
New Delhi
Dated the 11th Jan, 1972

No. BD/551/3/72

To

Shri R. K. Banerjea,
General Secretary,
India Society of Engineers,
12-B, Netaji Subhas Road,
Calcutta - 1.

Dear Sir,

With reference to your letter dated 15-12-71. I am directed to say that as employment opportunities in Bangladesh have not yet been fully assessed, we shall write to you again as and when your services are required there.

Yours faithfully,
Sd/- **A. P. Rellin**
Attache (Bangladesh Reg.)

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Sd/- JUGAL KISHORE GHOSE

Dated, 15. 3. 72

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SCIENCE & ENGINEERING

Vol. XXV No. 2 — APRIL 1972

IMPORT SUBSTITUTION IN 1972

In the import trade in India base metal and machinery constitute, more than half of the total trade. As early as 1966 base metal and machinery accounted for Rs. 700 crores, out of total trade of Rs. 1260 crores. Again the base metal like iron and steel, copper, aluminium, nickel, zinc and tin accounted for Rs. 166 crores.

Replacement of imported metal by indigenous ones can only be expected upto a certain point limited by India's mineral reserves and mining capacity for these metals and their availability. Recently intense search has been carried out by the Geological Survey of India for molybdenum and nickel reserves in this country, and the effort has met with some success recently. However there is limitation as regards reducing of imports of components, parts and spares not manufactured here. The imports for parts, accessories and other unspecified items in 1966 were as high as Rs. 376 crores annually against a total import of machinery ann transport equipment worth Rs, 473 crores.

Efforts have therefore been continuously made for development within the country of complete plants and machinery. In the textile industry there is now expandable indigenous capacity for blow room machinery, combing machines, draw frames ordinary and high speed simplex machines and automatic looms.

In the sugar industry there were already 7 manufacturers by 1966 for complete sugar plants, besides other units manufacturing specified parts. The plants are in the range of upto 2000 tons a day crushing capacity.

In the jute mill industry the annual production of jute mill machinery was to value of Rs. 3.63 crores and now much more. For paper mill machinery the annual production in 1966 was small, only Rs. 1.72 crores against a licensed capacity of Rs. 21.8 crores, with 19 firms participating. The position is somewhat improved now.

In the cement industry indigenous cement plants 600 tons a day capacity are now manufactured.

In the chemical and pharmaceutical industry more than 76 firms are now participating. Indigenous capacity now exists for manufacture of complete plants for manufacture of sulphuric acid, superphosphate, caustic soda, solvent extraction and water treatment equipments, besides items like pressure vessels, distillation stills, crystallisers, evaportors, heat exchangers and agitators.

For tea industry, all machines are now being manufactured in India. For boiler manufacture, over 17 units including one in the public sector are participating in production of over Rs. 23 crores a year.

In machine tools industry over 80 units with a total installed capacity of over Rs. 24 crores and annual production of Rs 17 to 20 crores cover a wide range of items.

In transport industry the country is now producing commercial vechicles, passenger cars, motor cycles, scooters and vans worth over Rs 30 crores a year. Production of petrol and kerosene engines and pumps are also taking place in increasing quantity, reducing very considerably the annual imports, which were as much as Rs. 22 crores in 1966, and for pumps and parts Rs. 7 crores.

In all these indigenous production varied from 50% to about 75% in 1966. Now it is from 80% to 100%.

The country is also now producing in sufficient quantity electrical machines like transformers, motor parts, and electrical motors of all categories

Of the critical raw materials nickel, tin, lead and zinc are scarce in our country, so also vanadium, molybdenum and tungsten. Recently however some resources have been located in the country for nickel, lead and zinc, and molybdenum. Production of copper at 4100 tons (1964) was only 50% of annual requirements. Accordingly the Government of India has taken over the copper works of the India Copper Corporation, and the Khetri Copper Works are also nearing production stage.

India is however rich in Iron, aluminium, titanium, magnesium, manganese, berryllium and zircornium. Hence steps have been taken to replace extensively copper with aluminium in the wire industry in the heavier V.I.R. & P.V.C. wire, and copper base alloys by aluminium base alloys in manufacture of electrical switch gears, and use of aluminium in place of copper, zinc or lead in manufacture of motors, generators and transformers and in paint and hardware, bronze fittings and foil industry.

The import needs of our country so far were classified under 4 categories (1) Maintenance, (2) Development, (3) Consumer Goods, (4) Defence Equipment. The target in 1966 was import substitution to an extent of 10 percent effecting a saving in foreign exchange to an extent of Rs. 200 crores annually.

It was also felt that concurrent with import substitution the country must attempt (1) to intensify export promotion to increase foreign exchange earning to purchase critical

raw materials requirements after allowing for import substitution, (2, to step up indigenous production of materials and machinery that have been so far imported (3) develop suitable substitution from relatively cheaper and adequetly available indigenous resources.

In 1972 things have taken a diferent turn. The American aid has been cut off. It has therefore become all the more necessary to effect at the earliest 100 percent indigenous production in almost all categories of capital and consumers goods and in machine and electrical, chemical and pharmaceuticals, in equipments and testing devices, in defence equipments and in transport, overland air and marine and under-water.

The Government of India has taken steps to identify and locate the areas in which there are shortfalls and where such import substitutions are necessary, and committees have been set up like the machine tools and equipments committees under the Chairmanship of Shri M. M. Suri to identify such areas and effect such import substitution with short term and long terms schemes.

The American aid cut has been a boon for our country. The country is now well set for a 100 percent self reliance programme.

AN APPEAL

The 1972 volume of SCIENCE & ENGINEERING appears with a new Frontspiece and Crest design. Opinions of Readers and ISE Members are invited.

Additional space for textual contents has also been provided. Articles and Notes on topics of interest for publising are welcome.

Advertising patronage and Subscription support from industry and other quarters are requested. Co-operation of ISE Members in this regard is specially expected.

G. L. SINHA
Secretary, Editorial Board.

SUBSTITUTION WITH ALUMINIUM

By

U. P. MULLICK (M)

Basic Qualities :

The several characteristics of aluminium that render it useful for industrial application are lightness, strength in alloy form, resistance to corrosion, high electrical and thermal conductivity, non-magnetic and non-sparking quality etc. It is also ductile and malleable, and hence machinable and it has good tensile strength.

Commercial Uses :

Aluminium has therefore extensive industrial use in the manufacture of electrical conductors, in chemical and food processing equipment, in canning and packing industry, and as structural component, in railway rolling stock, railway coaches, in aircraft, automobile and ship building, besides aluminium in chemicals, in paper and textile industry, in high alumina refractories, abrasives and aluminium wires. It it also used in decolorisation of sugar and in purification of kerosene.

World consumption :

The world consumption of aluminium is 5 million metric tonnes a year, which is expected to rise to 8 million metric tonnes a year by 1975.

Areas of availability :

The raw material is bauxite. In India bauxite occurs in Bhopal, Jubalpur (M.P.), Belgaum (Mysore), Kolhapur (Maharastra), Ranchi (Bihar). Kalahandi (Orissa), and in Salem (Madras State).

Aluminium Resources :

The present resources of bauxite in India are estimated at 250 million tonnes, out of which about 30 million tonnes are high grade having over 50 per cent aluminium content.

Site location :

High voltage transmission of Power now makes it possible to site aluminium smelters near the sources of raw materials.

Raw materials :

The raw materials required for one tonne of aluminium for production in a large smelter are .

	Tonnes
Bauxite.	5.5 (nearly)
Caustic soda.	0.2
Fuel oil.	0.3
Coal.	2.0
Calcined petroleum coke.	0.45
Pitch.	0.20
Cryolite.	0.05
Lime, filter cloth, Starch etc.	0.20
Total—	8.9

Production stage :

There are two broad stages of aluminium production. In the first stage the impurities in bauxite are eliminated by chemical means, and next pure aluminium oxide (called alumina) is separated.

Production in India :

The production during last decade has been rising as under :

	Tonnes
1956	6500 (tons)
1957	7784 (,,)
1958	8282 (,,)
1959	17249 (,,)
1960	18413 (,,)
1961	15908 (,,)
1962	35404 (,,)
1963	53596 (,,)
1964	55039 (,,)
1965 (Jan. to July)	32132 (half year)

Production has thus risen eight fold in 10 years.

Import to India :

Nothwithstanding the rising production the demand increased and there has been a rising import for the metal. The import figures are :

	(Rs. crores)
1950-51	2.9
1955-56	4.8
1960-61	7.7
1961-62	7.9
1962-63	10.5
1963-64	6.5
1964-65	7.2

Import substitution :

In the context of acute shortage of foreign exchange, it has become absolutely essential to find suitable substitutes for all such raw materials as are not available in India. There are 22 such critical raw materials. Next to copper comes aluminium.

The Director-General Technical Developments in collaboration with the industries and research laboratories, specially. National Metallurgical Latoratory have taken up steps to find suitable substitutes to reduce the import bills on the critical raw materials. Replacement of copper bars in rotors and in squirrel cage motors upto 30 h. p. ratings, and of copper and brass extrusions by aluminium alloys, and copper bus bars by aluminium equivalents in switch gear and control gear industries is expected to result in a saving of Rs. 0.35 million a year. It is also estimated that use of aluminium for copper for wires and strips used in transformers will effect an annual saving of Rs. 10 millions in foreign exchange. Also aluminium windings in electrical motors in replacement of copper wires will cut import cost by Rs 50 millions, thus total amount of saving in foreign exchange on these items alone comes to Rs. 60.35 millions.

The electrical conductivity of pure aluminium is 69.94 per cent on volume basis and 213.92 per cent on weight basis (International Standard Annealed copper). Aluminium is thus useful substitute for high tension and low tension overhead transmission wires. Such lines are now being made of aluminium conductor steel reinforced (AESR). Insulated cables with a few exceptions are also now being made from aluminium.

Third 5 year Plan covered substitution of bare copper conductor by aluminium conductors at 5000 tonnes for 1965-66, and estimated 15000 tonnes by 1970, substitution of 100 miles of paper insulated cables based on copper wire by aluminium wire in 1965, and estimated 1500 miles in 1970, substitution of copper by aluminium in heavier VIR and PVC wire to an extent of 200 million yards by 1965 and estimated 600 million yards by 1970.

Research and experiment have shown that aluminium has other uses as substitute. Thus it can be used in sheathing in power cables and for which lead is now used. It can also be used in antifriction bearing metals and in lamp caps where brass is now used. Aluminium can also be used as a substitute for zinc in the coating of steel strips. Its use in coinage has been taken up effecting a saving in foreign exchange. As a structural materials the saving in weight is 50% over the conventional materials.

A big substitute application is in the 'foil' industry. The term foil is used to metal sheets of less than 0.2 millimeters in thickness. Aluminium foil possesses flexibility, capacity for high reflectivity for light and heat radiation, and is thus a suitable packing material. Aluminium foil can also be used as insulation for cold storages. It is vermin proof and fire resistant, which are properties not possessed by mineral wool, cork and saw dust. The tea and cigarette industries have major use for aluminium foils. In the pharmaceutical industries the foil has found application for 'strip packing' of tablets. It has also application for packaging for milk products and bottle caps. A newest application for aluminium foils is for architectural coverings to ceiling boards and walls, and in false partitions.

Requirements of consuming sector :

The demand of aluminium processed ingots, bars, rolls, sheets, and foils are yearly increasing in India, both for basic and substitute requirements. Table 1 (see appendix) gives the requirements of aluminium by consuming sector for 1965-66 and 1970-71.

Expansion programme :

According to recent estimate of the Perspective Division of the Planning Commission, the total demand for aluminium will increase from 0.1 million tonnes in 1965-66 to 0.26 million metric tonnes by 1970-71. The Third Plan mid-term appraisal of production capacity was 68,000 tonnes only.

The expansion programme during Fourth Plan covers as follows : Indian Aluminium Company's Alwaye plant from 11,000 tonnes to 16,000 tonnes. Belgaum plant from 30,000 tonnes initial to 0.1 million tonnes at Rs. 300 million cost of investment. The expansion of other plants cover Hindusthan Aluminium (U.P.) upto 60,000 tonnes, Madras Aluminium from 10,000 tonnes to 20,000 tonnes, Aluminium Corporation of India from 8,000 tonnes to 16,000 tonnes. In the public sector the Koyna plant will be for 25,000 tonnes initial rising to 50,000 tonnes, and the Korba plant (M.P.) 0.2 million tonnes

Size of Plants :

The industry being capital intensive the minimum size of plant smelter capacity should be 40,000/60,000 tonnes a year.

Power :

Power constitutes about 20 per cent of cost of aluminium production.

Research work on Aluminium alloys as substitutes :

Recently research work has been carried out by National Metallurgical Laboratory at Jamshedpur on Iron aluminium alloys aimed at developing substitute alloys at elevated temperatures from furnace hardware to turbo machines to replace nickel bearing austenitic stainless steels. Besides heat resistance, the cheapness and availability of aluminium are incentives for using such alloys.

Experiment at NML shows that air-melted calcium de-oxidised iron-aluminium alloys

are not workable upto 12 per cent Al content. Beyond this Al percent, only cast alloys are possible for heat resistant uses. The 5 per cent aluminium group of alloys can safely be employed upto 800°C, while a 12 per cent alloy possesses adequate oxidation resistance at this temperature and upto 1000°C. Airmelted calcium de-oxidised ferritic Fe-Al alloys can be employed in hot worked condition upto 12 per cent Al content, and as in cast condition beyond upto 35 per cent Al.

Fe-Al-Mn alloys also provide cheap stainless alloys with good scope to replace stainless steel A composition of Fe-Al (6 to 8%)-Mn (20 to 25%) has been worked out by NML which shows a tensile strength of 45 Tsi, and elongation 11.7 per cent with good corrosion resistance. This is very encouraging in the field of alloy making, specially as Fe-Al and Mn are all available in abundance in India.

Research experiments at NML also show that use of aluminium with 4% Mg yield an alloy suitable for coinage purposes as substitute for nickel, and this alloy has been accepted by the Government of India for minting low denomination coins like one paisa, two paisa and 3 paisa coins.

Non-availability of nickel and cobalt in India has led to working out by NML of substitute. Electrical resistance alloys based on Fe-Cr-Al group substitute alloys has been developed by NML as Fe-Cr (10 to 20% — Al (3 to 8%) with small but significant addition of Zr and misch metal. Studies on accelerated life tests based on ASTM Standards of the substitute alloy compares favourably with the conventional alloys.

Research on substitution of zinc by aluminium carried out at NML also shows that it is possible to have hot dip aluminising of steel in place of hot dip zinc coating. Thus mild and high tensile steel wire, hardware items etc. based on optimum prefluxing and hot dip techniques with Aluminium have been carried out at NML with successful substitution results.

Research at NML further shows that resistance to high temperature oxidation can be conferred to steel both by chromium and aluminium coating. Aluminised steel is resistant upto about 800°C against chromised steel upto 900°C. Beyond these temperature, both oxide heavily.

Experiments are in hand for co-diffusion of Cr and Al. The complex oxide film that would result in service from Cr 203 and Al 203 and the lower oxides can be assessed for their protective values to arrive at a suitable coating for use above 1000°C.

Extensive work at NML now aims at developing soft aluminium base bearing materials that can be bonded to steel backing for substituting copper-lead and white metal type of bearing and solid plain bearing for bushing type of applications for replacement of phosphor-bronze, leaded bronze and similar types of solid bearings. It has been found at NML that soft aluminium base bearing with small quantity of lead and antimony may suitably replace conventional overlay type of bearing alloys. It is also found that aluminium bearing incorporating suitable quantity of zinc, silicon and magensium may replace leaded bronze and phosphor bronze for solid bearing application.

References

Dr. B. R. Nijhawan, Aluminium Alloys Symp. on Import Substitution, NML, April 1966, Jamshedpur, & Economic Times May, 1966.

U. P. Mullick, Critical Raw Materials and substitutes in the light of India's self sufficiency. Symp. on Import Substitution NML, April 1966, Jamshedpur.

NEW FRONTIERS IN DRILLING TECHNOLOGY

By

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Introduction

Time marches on relentlessly. It is irreversible. The 'swinging sixties' have passed into oblivion and we are on the threshold of the 'sweeping seventies'. The sixties have been a thrilling decade as far as the petroleum industry is concerned. There is hardly any country in the world to-day which is not engaged in the quest for this elusive fossil fuel, either on land or offshore. This dramatic spurt of activity reveals three significant facets the worldwide surge to the continental shelf, the emergence of the African continent as a major source of petroleum and the sudden egression of the Arctic as a possible new force in the international oil scene. With improvements and sophistications in methods and instruments of exploration, the old dictum, 'oil is where you find it' has given place to a new confidence, 'where (if) there is oil, we will find it'. There is a perceptible shift in the ownership and management of the oil industry. The cry of the seventies in the producing countries will be for 'participation' and to a lesser degree for 'nationalisation'. 'Concession' is a dead-word and 'agreement' and 'contract' are the semanitics of the seventies.

Consider technology or economics,-drilling technology forms the cornerstone of the oil industry. It is, therefore, quite pertinent that a good deal of attention is bestowed upon this crucial sector of the oil industry in order to give it a face-lift and to accept the challenges of the seventies. Novel drilling methods are on the anvil or are being tried out in the field ; new types of equipment and field practices are being evolved, and new materials are experimented upon. Let us have a look at these innovations to solve the mechanical and operational problems.

Developments in Oil well Drilling Technology

Rotary drilling is efficient in terms of the energy needed to remove the rock but the power output to the rock through rotary bits is a severe limitation (2-4% of the rig floor horse-power). Laboratory and field tests have shown that some novel drills have potential for drilling oil wells faster and cheaper than rotary drill bits. Mention can be made of drilling by downhole motors, erosion drilling, abrasion drilling, liquid percussion drilling, straight-hole turbodrills with diamond bits, drilling with explosives, etc. which may prove well in the company of automatic drilling rigs or flexible drill pipe. Entirely new concepts in rig design in the form of automatic drilling machines and the 'Flexipipe' retractor rig are being tried out. The gas turbine has invaded the rig prime-mover market, especially for use in small unitised rigs for helicopter transport to remote areas and for offshore drilling. Another concept full of promise and feasibility is the replacement of D.C. generators on electric rigs by A.C, generators and rectifying to get

D.C. Such an A.C. to variable voltage D.C. system, thanks to the development of large solid-state silicon-controlled rectifiers, is capable of handling the current needed on a rig. Jet bits have come into widespread use. The nozzles are made of mineral-ceramic alloys to ruduce the cost. Tricone bits with sealed greased bearings are already in use. Renewed interest is shown in diamond bits, especially those set with artificial diamonds. Replaceable bits are being developed; which would help drilling without hoisting the drill pipe for changing the bit. The 'borehole televiewer' has been evolved which provides a continuous log of the entire hole drilled and constitutes a valuable tool as a guide while drilling and a direct aid for petrophysical evaluation of the formations drilled through. No last word seems to have been said on the well-control problems. New light is shed upon the application of a number of parameters and detectors which may yield a timely signal for detection and control of anomalous pressure zones, so that, a blow-out can be warded off. The salinity principle, rig-floor detection equipment, etc. are some developments in this regard. A number improvements have been brought about in the technology of drilling fluids, such as the low solids muds, polymer muds, oil-base muds, etc. to combat the troublesome formations and difficult bottomhole conditions in deep well drilling. Similarly, materials and techniques for oilfield cementing operations have been constantly improved. For the analysis of drilling operations, increasing use is made of computers. Their role is gradually diversifying, even though a perfect programme for drilling is still some distance away. However, before the computers become the answer to all drilling problems, much attention is given to impart comprehensive training to the rig personnel in the fundamental aspects of drilling operations and their economics. This may lead to a substantial reduction in drilling costs.

Drilling in India

Drilling activity, in some or other and for some purpose or other, has been prevalent in our country since a long time. In the early years, it might have been in the form of percussion drilling for sinking tube-wells for water. This technique was also used at a stage in the development of the premier oil field at Digboi, Assam, Later, it has been in the form of diamond drilling for investigating the dam sites for the river valley projects and for exploration of metallic, non-metallic and solid fuel deposits. At present, the rotary drilling with its variations is widely used for exploration of petroleum. Thus, drilling operations of diverse nature and for different purposes have come to stay in the exploration and exploitation of the natural resources of our country.

Considering the organisations, which are or have been intimately connected with drilling operations, mention can be made of the Geological Survey of India, Indian Bureau of Mines, National Coal Development Corporation Dept. of Atomic Eenergy Dept. of Mines & Geology of various State Governments and other specialist organisations, for exploration of mineral deposits and ground-water ; the Exploratory Tubewell organisation of the Central Ministry of Food & Agriculture, which has gone in a big way for tapping underground reservoirs of water not only for civic purposes but also for the major purpose of irrigation ; and finally, the Assam Oil Co., Oil India Ltd, and the Oil & Natural Gas Commission, which have been engaged

in the spectacular task of drilling for petroleum.

But in sharp contrast to such proliferation of drilling activity, there is a perceptible gap in the availability of equipment, machinery and tools and of properly trained personnel, which only can sustain the efficiency, competence and economics of drilling operations. Only a beginning has been made to fabricate rig equipment and diamond bits, etc. are manufactured by a few firms in the country. Yet, the shortage of drilling machinery and tools even for drilling for water became quite evident when units were flown from abroad to locations in order to alleviate the drought stricken conditions in Bihar not very long ago. For oilfield drilling, the drill bits, casing and a host of other componants and tools are imported. It is time, therefore, that self-sufficiency in drilling equipment, machinery and tools is brought at the hands of such organisation as the N.M.L., M.A,M.C.O., H.E.C., H.S.L. etc. by evolving suitable designs and specifications and by fabrication of the equipment and tools.

Problem of Technical Personnel

The position regarding the availability of trained and qualified drilling engineers is much more unsatisfactory. Drilling Engineering/Technology does not figure ever as some part of the curriculum in any branch of Engineering. As such the qualifications for a drilling engineer are laid out on a very general basis. The diverse drilling operations are carried out by personnel who had no systematic training or motivation for the specific assignment. They just seem to enter the drilling profession more by accident than by any intention backed by through training. And once they are in it, they await gradual metamorphosis to a drilling engineer. Yet, all credit is due to them for their perseverence, excellent performance and results. However, in view of the rapid changes and innovations that are taking place in drilling technology, particularly in oilfield drilling on land and offshore locations, it seems to be quite necessary to train a distinct cadre of drilling engineers who will face the task ahead with confidence and sense of belonging to a profession, even if it is tough and challenging.

Training of Drilling Engineers

Several ways can be suggested towards this end. Drilling technology can be offered in the form of special subjects in the undergraduate course with a core curriculum of basic sciences, engineering and geology. Alternately, it can form a graduate course of two year's duration after an engineering degree course. The Institution of Engineers (India) may also consider drilling technology for inclusion as a sub-group of Mechanical Engineering, so that, eligible candidates can qualify in their professional examinations. The curriculum for drilling technology may comprise such subjects as drilling methods, equipment and tools, drilling fluids, cements and cementing practices, elements of geology, rock mechanics, drilling economics and management.

Practical training graded to match the institutional curriculum can be arranged with the help of different organisations engaged in drilling. It is then possible to turn out a drilling engineer who is conversant with all types of drilling and who acquires a greater degree of mobility and flexibility in his professional career.

Indian School of Mines, which is an Insti-

tution devoted training personnel for the exploration and exploitation of mineral resources, is an ideal one for training in drilling engineering as well. The Petroleum Technology Faculty is in existence at I.S.M. for the past one decade and the curriculum in Petroleum Engineering course has in it quite a strong nucleus of drilling engineering curriculum. A few Petroleum Engineering graduates have been serving the O.N.G.C. as drilling engineers and carved out a fair name for themselves and for the Alma Mater. But in order to provide a better incentive for the employer and an identity and motivation for the employee, it is worth while to offer specialisation in the whole gamut of drilling technology, either at the undergraduate level or at the graduate level, if so desirable. This would help in the creation of a cadre of drilling engineers who can find the various avenues of employment-organisations engaged in drilling for different purposes, design of drilling equipment and machinery and operational research. The trends and compulsions of exploration and exploitation of our natural resources warrant the services of such systematically trained personnel who can only elevate the profession of drilling to its desired level and usefulness. Continuing education can be arranged which is suited to the needs of particular organisation.

If this experiment in technical education cannot be tried out in a bold and imaginative way one may still continue to say. "Wanted rugged individual with excellent health and steady nerves to do exacting work in exasperating conditions, all hours. Persons afraid of jungles, deserts, fevers, sunstroke and solitude need not apply."

Who fails to read between these lines the traits of potential driller alias drilling engineer ?

END OF ANOTHER AXIOM*

By

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Parapharsing the well-known thesis that theoretical natural science ends where mathematics ends, we may, probably, maintain that a present-day experiment ends where radio-electronics ends. Its present boundaries are the boundaries of the trustworthiness of experimental cognition.

It is not difficult to see the now characteristic tendency of constant bonds of scientific accomplishment with its technical realisation. Physics begins any work in the sphere of electronics, and production and technology finish it. In this way there appear, for instance, semiconductors with intricate names such as thyristors and transistors,

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twistorns and klystrons, and this means that radio and TV sets grow more sensitive, that radars see to a longer distance and with greater precision, that the experimenter's instruments grow "powerful" and more "delicate". And this is followed by new physical phenomena.

Investigations into extremely interesting phenomena plasma effects in a solid—were started in recent years. Even for a specialist the combination of the terms "plasma" and "solid" is grating on the ears, probably, no less than the combination of an old minuet with fiery folk dances. Indeed, plasma is the fourth state of matter, a chaos of movement the force of which breaks matter up into electric charges of opposite signs. And where does the shapely symmetry of periodical structures forming the backbone of a solid body come in? What is there in common between them? But there does exist a common feature; the motion of electric charges.

Attraction of Plasma Research

What attracts the vast army of scientists to plasma research? It is the nature of our Sun and continuous communication with a spacecraft, quests for new energy sources and new electronic devices. All this involves plasma, but here it is gas-discharge plasma. The quantitative properties of plasma are characterised, first and foremost, by density, the number of charge carriers in a unit of volume. For gas-discharge plasma it ranges from a thousand to a dozen billion charges per cubic centimeter, while qualitatively the plasma state is manifested in the collective behaviour of charge carriers, or, as scientists say, in the existence of resonant plasma frequencies. The frequencies which plasma resonates at, in turn, are determined by the density of plasma and the magnitude of the external magnetic field.

Now, let us get back to the plasma of a solid. About 20 years ago, scientists discovered experimentally for the first time the effect of the sharp attenuation of the electron flux run through a fine metal foil—the electrons were losing energy on exciting plasma oscillations inside the metal. There appeared the term "plasmon"—a quantum of energy absorbed during this process. But what has plasma to do with it?

Free charge carriers have long been known to exist in solid electroconducting bodies, their density being incomparably higher than in gas plasma. So, if we matched a mechanism leading to the collective interaction of carriers in a solid, then in it, too, there should manifest themselves unusual plasma properties. It is the electrostatic screenage effect that acts, just as in gas plasma, as such a mechanism. This term means that the field of each charge interacts with the fields of its moving neighbours. This produces an already bound "team" which is more complex than in gas plasma. The point is that the neighbours are different now—there are fast electrons, and reserved "vacancies" (imitation of positive charge), and quite immobile charges forming the lattice. Everything is connected, everything moves and is electrically neutral on the whole—the field is confined within the "team".

Substantial Effect on Metal Properties

There is the term "skin-layer", and there is almost an axiom that if an electromagnetic wave gets onto metal, it does not "enter" it, but is reflected and attenuates in a micron-

thick-skin layer. On the other hand, in plasma in the presence of a certain magnetic field, there may spread a wave of practically any frequency. But the carriers of a charge in a solid manifest plasma-like properties. So, if a magnetic field is posed upon the metal, the wave must spread inside the metal, too.

The magnetic field really does exert a substantial effect on metal properties. The conductivity of the metal starts depending on the "direction" of the field. Thus, in a plane transverse to the direction of the magnetic field, conductivity diminishes, this being due to the rotation of electrons in precisely this plane. The current that is transverse to the magnetic field is now very small, and this means that the metal behaves in this plane as a dielectric, remaining an ideal conductor in the longitudinal direction of the magnetic field. For this reason, an electromagnetic wave, the electric field of which changes in the plane perpendicular to the magnetic field, must spread in metal, too. True, the wave that runs in the metal is, at first sight, not quite the usual one—its electric field revolves around the direction of its propagtion.

If anything still does surprise us, there are at least two relatively simple experiments that must evoke the pioneering thrill in us : the wave falls upon metal and does not pass through it. But the instant a longitudinal magnetic field is superposed, the metal "clarifies" and the wave passes through it, and with small attenuation, at that.

Here is another example. A semiconductor specimen is placed in a magnetic field and a direct (take note !) electric field is superposed, and...the semiconductor material starts emitting energy with a frequency of billions of cycles. Physicists have never expected such a turn of events, from direct current to superhigh frequency generator, to the core of the locator.

Effects in Visible Future

What are these effects bound to produce in the visible future ? They will yield new methods of comprehensively analysing conducting materials (experimental installations are working already), new methods of radiation generation (capacities are still low, but the principle is quite correct) and new methods of transforming energy.

Of great interest are the quite recently investigated various controlling elements operating in the millimeter-wave range. This applies particularly to the so-called irreversible devices, depending on the magnetic field direction they let the wave of one direction pass and weaken it by a thousand times in the opposite direction. The role of electron flux in some instruments may possibly be played by a plate with plasma of a solid. Does this sound as Utopia ? You can never know. The already available i n s t r u m e n t s are still unshapely and can hardly compete with their elegant rivals, but the object to study is extensive and new enough to draw the researcher's interest.

Victor Hugo once expressed the apt idea : "As science advances, it constantly cancels its own self." This seems to apply to plasma effects in a solid. So far, however, laboratories are studying the spread of an electromagnetic wave in metal. Another axiom has come to its end.

PSYCHOLOGY IN INDUSTRY

Psychology Plays an Important Role in Modern Industry

By

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At the present time Psychology is defined as the science which studies the mind or mental processes.

Psychology plays an important part in the life of individual also.

The aspects of an individual's mentality which have been studied in some detail and for which tests have been devised, may be classed under seven heads.

1. Sensory, 2. Efficiency, 3. Motor efficiency, 4. Rapidity of reaction or response, 5. Attention, 6. Memory imagination, 7. Relationed thinking.

It must be clearly recognised that the possession of a high intelligence is not necessarily a guarantee of success in life.

For all practical purposes of life, social intelligence wins over abstract intelligence. There are three general characteristics of all mental life, which seem to be at the root of all learning and all memory. Every living organism therefore has its history, so to speak, recorded in itself. Without retention or conservation there could be no learning and progress of any kind. A man tends to think and act always along certain lines through force of habit. It is important that many of our every day acts should become automatic. The more of the details of our daily life we can hand over to the effortless custody of automatism, the more our higher powers of mind will be set free for their own proper work. To choose a carrier is to make a momentous decision, for on the choice depends to a large extend the individuals future happiness. To be wedded to a vacation for which one has neither apptitude nor inclination, or for which one has a strong dislike, must indeed make life very miserable.

In addition to the constant strain to the individual himself, there is great loss to the employer, since spoiled work, imperfect work, off days, sickness real or feigned and constant change of work can be traced in many cases to unsuitability of worker and work. Vocational guidance is an attempt to place the choice of one's job on a more scientific basis. It tries to guide the individual into a vocation for which he by reason of his endowment, physical and mental is particularly fitted. The carrier that seems most fitting for an individual may not be most practical and a choice may require to be made of a second test. The application of psychology to conditions of work has been marked by steady progress. The main object through out has been to improve the conditions of work, thereby making them as congenial as possible to the worker.

One very important cause of unnecessary fatigue, for example, arises from the posture of the worker.

Bad illumination is another source of unnecessary fatigue, as is also bad ventilation.

A system of uniform lighting over the whole visual field seems to be the most satisfactory arrangement.

Another attempt which has been made to reduce fatigue in work is by introduction of systematic pauses for rest.

In most industrial processes there are three sets of movements. One set which is necessary for the performance of the work, a second set made necessary by the bad arrangement of tools perhaps or due to the unexperience of the worker, which can be eleminated, a third set which is dependent on the individual rhythm of the worker. Not only is the efficiency of work, determined by the physical, sensory, intellectual and motor characteristics and capacities of the individual worker, but the efficiency of industry as a whole, as well as the efficiency of the work of the individual is largely determined by factors which emotional and volitional feeling rather than physical, sensori-motor or intelectual. The full significance of industrial life of this aspect of human nature has only been recognised in quite recent times and the scientific study of the various practical problems involved has barely began.

Among the most important of these fundamental motives of the human being are the instinct or impulse to acquire goods, property or wealth, the impulse towards self-expression or self-display, sometimes spoken of as the desire for powers or for prominence, the aggressive impulse and the impulse to escape from dangerous or painful situations. The chief incentives in industry not the only incentives by any means depend on the operation of one or more of these impulses.

The importance of the team workers spirit from the point of view both of the happiness of the individual worker and of the efficiency of the work, can hardly be over estimated. The problem is how to develop it.

The essential condition is that the work should be in some way identified with the individual himself, so that he feels that efficiency of the factory, let us say and its reputation reflects upon his efficiency. To satisfy this condition the best plan would appear to be to give the workers themselves a very considerable say in the organisation of the work and in the guidance, generally of the policy of the industrial undertaking.

In practice psycho-analysis is an application of the experimental method of free association.

Bibliography

'Psychology and practical life' By—Mary Collins & James Draver.

Notes & News

Arvi Station Named after Dr. Sarabhai. The Satellite Communications Earth Station at Arvi near Poona was named the Vikram Earth Station and dedicated to the nation by the President Shri V. V. Giri at a ceremony at New Delhi on February 26, on its completion of one year of operation.

The station is being operated by the Overseas Communications Service of the Ministry of Communications.

With this gesture, the OCS and the nation have paid a rich tribute to the late Dr. Vikram Sarabhai for his contribution to the space communications effort in the country. Under the late AEC Chairman's leadership and guidance, the Department of Atomic Energy played a major role in building the Station with considerable Indian expertise and material.

The Station stands on a site of about 92 hectares at an altitude of 680 metres. Arvi is in the middle of a natural bowl formed by surrounding low-lying hills, affording natural shielding against outside microwave systems.

The Vikram Earth Station works with the Indian Ocesn Satellite IS III (F3), located at a nominal longitude of 61.4°E and is capable of providing direct links to all countries from U.K. in the far West, to Japan in the far East. The Station enjoys a favourable look angle of 64° to the Indian Ocean Satellite.

The Station has been planned to provide all forms of international telecommunication facilities including telephone, telex, telegrms, radio photos and data transmissions. Additionally, the Station can handle television programmes whenever relayed *via* satellites. The Station has been designed for 99·9 per cent reliability of operation, achieved by means of stand-by facilities.

Centre of Materials Technology and Science : NAL. Advances made in aerospace vehicles elsewhere in the world have given rise to the development of improved and new materials and novel techniques of fabrication. The lack of such materials and techniques in India has become a great drawback for building truly indigenous aircraft and aeroengines. The Materials Science Division of the National Aeronautical Laboratory (NAL), Bangalore, since its inception in 1966, has made considerable progress in the development of materials and material processes for both metallic and non-metallic materials required in aerospace industry.

The creation of a Materials Technology and Science Centre with the Materials Science Division of NAL as nucleus was recommended by the executive council at its meeting held on 22 March 1971. The Governing Body of CSIR at its meeting held on 9 August 1971 considered this recommendation and approved the creation of Materials Technology and Science Centre, which would be an integral part of NAL.

The ultimate function of such a centre is to specialize in the science of materials leading to new tailor-made materials and novel processes and products. This involves considerable basic research. As these activities

are of importance to industry and require concerted efforts, the centre would : (1) lay a strong foundation both in developmental activity and research ; (2) interact effectively with industries interested in specialized materials, material processing and testing ; and (3) actively collaborate with scientists and technologists from universities, research institutions and industries.

Initially, the main tasks of this centre would be : (1) fabrication and procesesing of materials by unconventional methods ; (2) development of composite materials with high strength-to-weight ratio ; (3) development of high temperature materials, particularly titanium and chromium alloys ; (4) development of specialized materials for avionics ; (5) study of properties of materials under extreme environmental conditions ; and (6) undertaking of testing procedures consisting of fractography and failure analysis, and development of advanced testing and characterization procedures.

The activities of the division at present include : development of composite materials, high temperature alloys, light alloys and sophisticated techniques for fabrication and material testing, and high pressure studies and fundamental studies.

Creation and Transfer of Metallurgical Know-how : An international workshop on Creation and Transfer of Metallurgical Know-how, organized by the United Nations Industrial Development Organization (UNIDO) was held at the National Metallurgical Laboratory (NAL), Jamshedpur in December 1971. The workshop discussed problems concerning the difficulties, modus operandi and objectives for the creation of specialized metallurgical expertise and technical know-how, and prerequisites for the establishment of metallurgical industries in developing countries. The participants at the workshop included nine experts from various countries, viz. Hungary, West Germany, USA, UK, Japan and India, besides fellows from developing countries, viz. Turkey, UAR and Argentina.

Principal recommendations of the workshop are as follows : (1) Developing countries should achieve progressively increasing technical self-sufficiency. (2) Repetitive import of metallurgical know-how should be avoided and where technology is imported it should be improved upon and modified to indigenous conditions to develop local talent. (3) UNIDO should act as antenna in ensuring that the metallurgical know-how thus transferred leads to the development of technical consultancy services in the developing countries themselves. (4) UNIDO should assist in the formulation of development programmes of metallurgical industries and techno-economic evaluation of new metallurgical projects and sponsor the preparation of detailed project reports and should catalyze the establishment of centres of metallurgical technology in the developing countries. (5) UNIDO should assist in the formulation of these metalluagical centres and in the expansion of such centres in specialized fields where these already exist. (6) UNIDO should also assist in the training programmes of developing countries so that cadres of trained metallurgists are created to effectively implement the know-how transferred from the developed to the developing countries. (7) Metallurgical technology thus developed within a country should lead to a chain reaction growth of the mineral and metallurgical industries based on sound

techno-economic parameters. (8) An internationol group of metallurgists should be set up to further the promotion of metallurgical technology and specialized technical know-how from the developed to the developing world. (9) While it may be necessary to provide foreign experts and technicel consultancy services to the developing countries, local talents must be developed and harnessed so that these countries stand on their own legs and be technically self-sufficient. (10) Technical experts and consultancy services should be provided by UNIDO in order to develop technical consultancy services in the developing countries themselves for the growth and development of their metallurgical industries.

Automatic Flaw Detection. A new flaw detection device that automatically detects flaws in steel sheets and plates as they come out of the production line has been developed by Nippon Steel of Japan. It replaces the present method of detecting surface flaws by the naked eye.

The optical device with its unique flying spot scanning system has great sensitivity. The degree of flaw detection can be adjusted to suit the requirements of quality control. The system is unaffected by light from outside sources.

The technique consists of focussing light through a slit on a sheet or plate by means of a long focus lens system comprising a conical surface mirror and a high-speed revolving mirror. As the focussed light moves across the sheet or plate, any flaw is indicated by a change in the reflected light that is passed through a photomultiplier tube. The reflected light is transformed into electrical signals which are classified by a signal processing circuit to detect the flaw.

The device can also detect flaws in transparent objects like glass plate, vinyl film, plates of acrylic resin or polyethylene. For this purpose, a flat mirror is placed under the subject and the translucent light reflected by the mirror is processed to detect inner defects of the sheet.

Laser to Detect Air Pollution. Rapid, on-the-spot identification of pollutant gases in air may become possible using a laser-light technique devised by two Bell Laboratories scientists, C. Kumar N. Patel and Lloyd B. Kreuzer. It can measure oxides of nitrogen—the main pollutants found in automobile exhaust and smoke stack emissions—in quantities as small as ten parts per billion parts of air. The technique may also be useful for other major pollutants like carbon monoxide, hydrocarbons, lead compounds and sulpher dioxide.

Each of these gases absorbs part of the energy from a laser at specifie frequencies when the laser beam is shone through the gas. By careful measurements the scientists can determine the kind and amount of gas pollutants.

Since the experimental system used is not portable, the air samples are collected in a flask, then brought back to the laboratory for testing. The testing equipment includes a tunable laser, called a "spin flip" Raman laser designed by Patel. The system includes a powerful electromagnet used to "tune" the laser beam to a desired frequency, a fixed frequency pump laser and a rotating shutter to interrupt the beam at regular intervals and cause a pulsing action. The laser beam is

directed into an optoacoustic absorption cell containing the sample. The cell contains a sensitive microphone, with a cylindrical diaphragm, which converts changes in air pressure into electrical signal, the strength of which can be recorded on a meter, oscilloscope or on graph paper.

With the new technique air samples as small as one cubic centimeter can be tested in four seconds.

Fuel Briquetting Plant. Small lumps of coal, coke and charcoal are widely used in India as domestic and industrial fuel, but their dust, millions of tons in quantity, remains unused, creating dumping problems. Most coal producing countries of the world make fuel briquettes from this waste. The briquettes are economical to transport, easy to handle, provide a higher heat value, and are comparatively cheaper.

Shri Prem Goyal of Bharat Industrial Corporation of Calcutta has perfected a process and a plant for making briquettes from coal dust for domestic and industrial use. This development has effected a recurring annual saving of over Rs one million on capital equipment, besides helping in the utilisation of an industrial waste piling up at steel mills and collieries. The Board on Awards for Import Substitution has awarded a Silver Shield to the company and Certificate of Merit to Shri Goyal for this effort.

The process consists in grading and screening the raw material and blending it with binders like coaltar pitch, sulphite lye, cement, clay or cowdung ; grinding and mixing ; and briquetting. The plant developed is simple in operation and produces solid fuel briquettes of uniform quality without application of heat in the process. It comprises a blending machine, a briquetting machine and a ring roll press. The blending machine is a steel drum fitted on a steel rod axel and equipped with five brackets. The briquetting machine has arrangements to grind the blended material to uniform mesh and to pass it automatically to twin-axis mixer for thorough mixing ; the mixture is then extruded under high pressure at a rate of about one ton per hour. The extruded material is passed over to the ring roll press which runs at about 10-12 rpm and exerts a pressure of about 1,500 kg/sq cm, turning out highly consolidated semi dried briquettes.

The indigenous plant is designed to produce briquettes of uniform size and weight of standardised heat value. The briquettes produced have more than 40% higher density and 95% fixed carbon value than ordinary coke lumps, thus giving a higher heat value for a much smaller bulk.

This plant can also make briquettes from such waste materials as bagasse, paper waste, wood waste, saw dust, grasses, rice husk, and wood shavings.

The fuel briquetting plant which can be installed at a capital cost of only Rs. 80,000 for 8 ton/shift production is being manufactured by Bharat Industrial Corporation, 6/C, Collin Street, Calcutta-16.

Spherical-Particled Nickel Powder. Type 123 nickel powder, the standard grade of nickel powder made by International Nickel, has a very small particle size and the surface of each particle is very irregular with large radial spikes. The large surface-area which results from these characteristics makes

the powder highly suitable for conventional powder metallurgical applications, e.g., load-bearing sintered steel components as used in the automotive industry. However, when particles are required to pack well, to form after sintering a porous body of controlled pore size, a smooth spherical particle shape is preferred.

Recent investigations by International Nickel demonstrated that the carbonyl process is capable of modification to give a range of particle shapes. As a result of this development, a powder consisting of rounded particles with a much reduced spikiness of the surface, has recently been added to our range of nickel powders. Known as Type 435, the new powder has a high apparent density (3.2—3.8 gm/cm^3) while the chemical composition is typical of the high-purity carbonyl nickel powders. It may be noted that the carbon content at 0.02—0.06% is lower than that of the standard Type 123 powder.

Because of its particle size and shape and because of its high purity, Type 435 nickel powder is proving useful in gas-diffusion electrodes such as those used in fuel-cell systems.

Low Carbon Nickel Overcomes Stress Corrosion Problem. The concentration of caustic alkalies and similar products with high boiling points presents extremely difficult technical problems and requires specially designed processing plants. For many years the Bertrams Company of Basle, Switzerland, has successfully used low carbon nickel in the construction of special equipment necessary to overcome these problems.

The corrosive effects of the products and the high operating temperatures demand special materials and appropriate construction, design, handling and processing expertise. For example, the problem of high thermal stress levels has been overcome by replacing the conventional tube bundle in the concentration plant by individual heat exchanger tubes which are free to expand in any direction. These concentration tubes are 2—4 in (50—100 mm) in diameter with a length of 3.8—7.6 m (12—25 ft) and are now mass produced in low carbon nickel.

The long life of low carbon nickel makes it an excellent choice for use not only in the equipment in the concentration process, but also in the installation for the subsequent processes in which the highly concentrated alkalies come into contact with the equipment.

SCIENCE AND ENGINEERING

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SCIENCE & ENGINEERING

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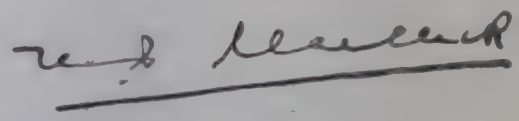
ENVIRONMENTAL CONTROL

It is widely felt that mankind within a short period of time will be subjected to a very great, probably on catastrophic dimension, environmental hazards unless drastic counter measures are taken soon. If the present rate in increase of population contiunes for a few decades, and in the exploitation of natural resources and use of energy, pollution of land, air, and water and urbanisation continues at the present rate of growth, then living condition all over the world is bound to deteriorate fast. Processes can even begin that can endanger life in any form on Earth.

As a counter measure growth in population has to be severely restricted, and if possible stopped. We do not want to see millions of children born to a life of hunger and misery, and to insufficiency of land. The biologically renewable resources should not be exploited beyond ecological tolerance levels. The discharge of toxic and noxious substances into nature has got to be limited within tolerable and safe limits. Then again the resources that are not renewable have to be exploited rationally and in the interest of all. New cities have to be planned so that they do not present conditions that go against safety of environment and living conditions. Hence research and development will need to be directed to these ends, and suitable laws should be promulgated and international understanding and cooperation reached in this regard.

A prerequisite for action is a growing realisation among opinion building circles in all countries, that far reaching measures are actually necessary. While such measures will affect political and social conditions in many ways, they also require new priorities for budget outlays, legislation, investment, city and regional planning, and a newer appreciation of social values. It was a happy thing of great foresight that Sweden in 1968 initiated a general debate on the environment in the highest existing international forum, the General Assembly of the United Nations. The objective on the one hand was to increase the knowledge of the character and threats to the environments, and on the other hand to make use of such opportunities as the international system could offer.

Some progress is already evident in achieving these goals. Other countries like U.S.A., Russia are quite aware of the problems also, as evident from the expressions of anxiety from the authoritative persons of those countries. The U.N. Conference can be a starting point for a comprehensive action programme with clearly defined tasks assigned to the appropriate institution.



BARC'S HEADWAY WITH RADIOISOTOPES

The Isotope Division of the Bhabha Atomic Research Centre continued production, and development of applications of radioisotopes. Dnring the year, the sale value of radioisotopes, equipment and services rendered by the Division totalled Rs. 37.73 lakhs, including Rs. 5.06 lakhs in export. Significant progress has been made at the Division in the designing, fabrication and setting up of large gamma irradiators. A variable dose gamma irradiation facility known as panoramic batch irradiator (PANBIT) has been constructed at Trombay. Loaded with an initial charge of 10,000 curies of cobalt-60, this facility is being used for the evaluation of processing parameters and development of wood polymer and fibre polymer composites. A panoramic field irradiator known as "gamma shine" has been developed specially for use in agricultural research. One such unit loaded with 1,000 curies of cobalt-60 has been installed at the Osmania University, Hyderabad for use in agricultural research.

Preliminary work on the setting up of a demonstration plant for irradiation sterilisation of medical products with United Nations Development Programme assistance has started at Trombay. The plant is expected to go into operation by the end of 1973. It will be capable of treating 300,000 cu. ft. (approx. 8,500 cu m) of medical products per year initially and is designed for a maximum capacity of 1 million cu. ft. (approx. 29,000 cu. m.) of materials. The products proposed to be sterilised in this facility include cotton-wool, catheters, disposable syringes, sutures, surgeon's golves, etc.

LIMNOLOGICAL STUDIES OF INDIA'S LAKES & RIVERS

By

U. P. MULLICK, (M)

PUBLIC HEALTH ENGINEERING

Synopsis :

The paper shows the great need for proper limnological investigations, on conditions of phytoplankton chlorphyll, water load on water basins and running rivers, and registering the data and transfering the data to a data processing system. General environmental condition, water chemistry, plankton and bottom fauna have corresponding influence on the fish fauna, and changes in fish population can be explained through careful analysis of the food chain.

Introduction

Since many years the deterioration and eutrophication of fresh and coastal waters have been steadily accelerating. There were warnings from the limnologists, but these were not widely heeded till last decade.

Now comprehensive investigations have been initiated in most countries. Studies of actual conditions of lakes and running waters have been now taken up, recommendations for improved treatment of municipal and industrial waste discharges are being made, and remedial measures are being taken up in these countries.

These bodies of water are susceptible to over-use. Population densities and industrial development increase on the shores. Lake waters are also used for municipal and industrial water supplies, for shipping, fishing and recreation.

In India amongst the Lakes, there is the Chilka Lake, Sambar Lake, Kodaikanal Lake, the Artificial lakes created by Damodar Valley Corporation and other Hydroelectric projects. No long term limnological studies about these lakes have been taken up. Nor such studies have been extended to rivers like the Ganga the Bhagirathi, the Hooghly, the Damodar and the other important rivers of India. Many industries have been built on the banks of these running waters, and industrial wastes are discharged into these rivers. Investigation in these large expanses of water will not only give information about present condition but will also produce materials upon which future comparison and studies of year to year changes can be based.

Overseas Studies :

Long term studies of Sweden's large lakes initiated during the last decade reveal increasing deterioration, especially around the peripheries near population and industrial centres. For example Lake Malaren is a very complicated system of water. It is composed of numerous bays of different shapes and depths.

There are marked natural variation as well as differences in the chemical condition prevailing between the western and eastern regions. There can be high natural concentration of calcium and high value of specific conductivity in one area, and again municipal

and industrial wastes in other areas have a considerable influence, and bring about changes in natural condition.

Lake Malaren is 115 km in length and 65 km in breadth. Maximum depth is Ca 66m. The drainage basin is 22,600 km^2. There are 14 lakes larger than 10 km^2 within this area. The lake is also covered by ice during 110 days in a year.

Around lake Malaren there are 1,350,000 inhabitants. Of the employed persons Ca. 55,000, 40% work in industries and 10% in agriculture. In north western part of the drainage area there is a mining district. Metal and engineering industries, food, chemical and pulp and paper industries also occur. The lake also receives sewage water from 1,100,000 persons. Since 1968, about 20 sewage plants have been equipped with chemical treatment facilities, and another 50 such plants will be added by 1972.

Taken as a whole Lake Malaren has a high concentration of plant nutrients. The lowest values are concentrated in central area, while the peripheral areas are influenced by population and industrial centres. There are also enormous discharges from the production of nitrogen fertilisers. Nitrogen value in the lake is naturally very high. Changes in PH condition also occur, which in turn affect the fauna and enhances fish killing. The annual nutrient load on the lake Malaren is about 90 kg nitrogen and 7 kg phosphorous per hectare. These figures are the highest obtained in Sweden's large lakes, figures for lakes Hjälmaren, Vänern and Vattern being slightly lower.

Indian Condition :

Conditions in India are some what different from those obtaining in Sweden. Nevertheless the large lakes like Chilka and Hydro-electric impounded lakes of which there are many, Salt Lake Calcutta, rivers like Ganga, the Hooghly, present problems of decay which to some extent resemble those of Sweden.

Studies can be initiated and expanded in India on Physico-chemical section's hydro-electrical and sedimentological studies. More exhaustive studies can also be carried out in higher plants vegetation (aquatio macrophytes), bottom fauna and fish.

Transparency :

In the physico-chemical division, all water samples can be analysed for conductivity, PH, silica, organic matter, oxygen and turbidity, major constituents and minor constituents including silica. Temperature and Secchi disc transparency can be measured at the sampling stations.

The white Secchi disc, 25 cm in diameter, is a simple instrument for measuring the transmission of light in water. A value of Ca. 6m has been recorded during the winter in the central part of the Swedish lakes, reducing to other parts to less than 2 cms. and in polluted area to a decimetre.

Conductivity values can also vary widely. It can vary from a total salt concentration of Ca. 90 μS 20 to more than 250 μS 20.

Nitrogen & Phosphorous :

Concentration of nitrogen and phosphorous can have a determining effect on the distribution and quantities of plants and animals in a lake.

Within the biological section analyses can be performed on the producers ; Phytoplank-

ton and macrophytes including chlorophyll concentration and primary production : the consumers : Zoo plankton, bottom animals and fish, and the decomposers : heterotrophic bacteria. With the biological samples taken synchronously, it is possible to attain an average picture of conditions in the lakes and waterways and it is possible to establish correlations between different parameters.

Flora :

The mean concentration of chlorophyll in summer (May to October) is around a (mg/m^3). Concentration of phytoplankton and chlorophyll generally correspond. Any difference can be partly explained by the fact that the chlorophyll content varies in different algal groups. A study of the list of quantitavely important algae from the lakes can show predominance of diatoms and coloured flagellates (cryptomonads), along with water-blooming blue-green algae (cyanophytes) in more polluted areas. The highest value of the total volume of phytoplankton in central parts of lakes can be near 4 mm^3/l ranging to 15 mm^3/l in other parts.

Fauna :

The supply of phytoplankton organisms is for the most part used as food by the zoo-planktons, and values recorded can be as high as 45 $mm^3/5l$. Planktonic crustaceans (cladocera) can predominate in samples.

The bottom fauna gives a very good indication of the water quality. The proportions of relict crustaceans are generally high in central portion, and they decrease in number or disappear near the periphery, while true midges (chironomids) and worms (oligochaetes) increase. The latter group are less available as food for fish.

Plant nutrients :

Sampling in Swedish lakes have shown high concentration of plant nutrients in the two western water basins resulting in very high biomosses (total flora and fauna contents) : phytoplankton Ca. $18mm^3/l$ and chlorophyll 288 mg/m^3 (mean value 1966-67). Sampling at station 78 showed that concentration of total phosphorous and nitrate nitrogen were increasing rapidly. From total phosphorous concentration of about 25 mg/m^3 in 1930 it has increase to 135 mg/m^3 in 1964-65.

Phytoplankton :

The primary result of increasing input of plant nutrients into the lakes and running water is a change in the composition and quantity of phytoplankton.

In the deterioration of the water quality, green algae (chlorophyll) and the yellow-green flagallates (chrysophyceans) are of secondary importance. There occurs predominance of cyanophytes (Anabaena Microcystis and Oscillatoria) in summer and diatoms, particularly in hot summers.

While there can be a general tendency for cyanophyte and diatom generally to become more and more predominant, desmids and chrysophyceans, which mainly occur in unpolluted water, can disappear.

Chlorophyll :

The maximum values of chlorophyll a (mg/m^3) can vary with different years, resulting in change in water transparency. Long term observations are needed for a correct estimate of the development. Lake Vättern showed a secchi disc transparency of 17m in 1888, and 11m in 1951.

Higher Vegetation :

A good basic collection of data on the macrophyte vegetation in large lakes and water ways is necessary for comparative purposes, and it can be obtained by aerial photography. The photograph can be with panchromatic film and with intrared sensitive film.

Change in water quality ·

The bottom fauna gives a good information about change in water quality. The species Pontoporeia a Hinis belong to the relict crustaceans which are most valuable as food for fish. With increasing load on the lakes, waterways and rivers, it will move away to more central parts in lakes and to less polluted areas in the waterways.

Fish catches :

With changes in water condition and degrees of load and pollution, there generally occurs changes in different fish species and extent of catches. Total fish catch per Hectare is recorded to have diminished from 4.5kg. in 1964 to 2.6kg. in 1969. Concentration of mercury in fish and increasing occurrence of fish parasites also can affect fish catch.

Information about fish and fishery is always difficult to obtain. Many factors influence the values from different years and from specific periods. However general environmental condition, water chemistry, plankton and bottom fauna are known to have corresponding influences on fish fauna and on productivity. Most of the changes in fish population can be explained through change in the food chain.

What is needed is a compilation of all limnological investigations in India, for establishment of a network for both chemical and biological analyses data to be given as maps and registers, and then transferred to a data processing system for scientific studies and other useful purposes.

Note :- Paper Received by India Society of Engineers on 5. 6. 72.

References :

1. Torbjoru Willen. The gradual destruction of Swedish Lakes. Ambio, Royal Swedish Academy of Science. Vol. 1. No. 1. 1972 pp. 6-14.

2. T. Abl. in Eutrophication in large Lakes and impoundments. Uppsala symposium. May 1968, OECD, Paris 1970.

APOLOGIA

Under some inordinate circumstances, SCIENCE & ENGINEERING for May 1972 could not be brought out. To compensate the lapse caused once again, additional textual space has been provided for in this and subsequent issues. we trust, readers will bear with us:

G. L. Sinha

Secretary, Editorial Board.

CERTAIN COST REDUCTION TECHNIQUES FOR COMMERCIAL RICE MILLS

By

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Very often it happens that even though a development project has been proved to be economically profitable and highly desirable from many different points of view, the initial capital outlay needed, as well as the operation and maintenance costs may present a formidable obstacle in the way of practical realisation by individual entrepreneurs. However, this should in no way discourage the Industry from taking advantage of modern developments since the initial cost problem can always be surmounted by devising adequate financial arrangements through group discussions. The main point to be recognised is the technical feasibility and the resulting advantages to the nation. Nevertheless, one would still want to know whether there are other solutions by which cost can be minimised so as to bring the modernisation programmes within the financial capability of a wider section of the industrial community. The present paper seeks to highlight certain cost reduction factors with particular reference to the Rice Milling Industry.

Economy in Storage Facility

The cost of storage silos has often been held to be beyond the reach of many Rice Processing installations. However, it is recognised that some form of storage is needed for a mill to work with a high through-put efficiency. Some would argue that in situations where paddy is available for sale in the market over a major part of the year, there is little need to provide for storage arrangement and money can be saved by avoiding storage structures. This argument overlooks the fact that while paddy may be available round the year, the losses taking place in conventional storage units and the additional profit margin of the sellers, would be fully and heavily reflected in the purchase price of paddy that the millers will be obliged to pay. Evidently therefore, the absence of modern storage arrangements with the miller means in effect that the burden of losses, both quantitative and qualitative, is completely passed on to him. Is it therefore an economic proposition to ignore the building of adequate storage potential for the Rice Milling Industry? Having conceded that storage provisions are worthwhile for this industry, what form or type of construction is most appropriate for a ricemill, may next be discussed. Silo costs in some of the pilot modern Rice Mill centres in India were rather high. But subsequently certain modifications in design were introduced that brought down the cost of these units by 20%. Still further improvements are possible by using the space between groups of silos as additional storage volume. These are commonly known as Star bins. Also the conical hoppers of conventional silos can be changed to 'sloped-floor' hoppers for increasing the storage volume. These modifications together can bring down the

silo cost by as much as 33% from the cost of the standard type of silos, as explained by the writer in the journal 'Science and Engineering' in June, 1970. Proper proportioning of silos is also an important factor in keeping expenditure to the minimum. The initial cost of silos including mechanical handling equipment may be higher than that of shed type buildings by about Rs. 60/- Ton, but this excess is wiped out in 3 to 4 years even if we consider the interest to be paid on this extra Rs. 60/- Ton. This is due to the grain saved during this period. Since silos can last for much longer periods and as the maintenance expenditure is negligible, one would do well to reflect more seriously on the merits of this form of construction than has been the case hithertofore. Additionally modern processing operations are greatly facilitated in silo storage. Land cost will be much less if silo construction is adopted, as this is a vertical form of storage. Losses due to pilferage and spoilage can be eliminated in silos

New form of Horizontal Silo

Another form of construction that has all the advantages of silos and in addition can compete with shed type buildings even in the matter of initial cost, is the 'catenary type horizontal silo'. In this facility, we achieve maximum space utilisation while as the same time avoiding the effects of side thrust due to grain. The roof and wall are one and the same here. A unit 60'-0" wide and 100'-0" long can hold roughly 1400 Tons of paddy. A costing of this horizontal silo on the basis of the latest schedule of rates for Delhi, indicates that even a bag storage shed with sheeted roof cannot be built these days at a cheaper cost than this type. Hence, this new innovation opens up tremendous possibilities for cost reduction for modern grain processing installations.

Cost Reduction in Mechanical Drying

A second important avenue for cost reduction lies in mechanical drying. The present high cost of drying is primarily due to high fuel consumption. Why not therefore substitute furnace oil by paddy husk which is available free as a bye-product ? Some mills have already started using husk fired boilers and the steam raised is fed into heat exchangers for producing hot air. Even in so doing, there is a 'double conversion involved', (i.e.) instead of burning husk and utilising the heat in a suitably designed heat exchanger for producing clean hot air, these mills raise steam and from steam, the hot air. Wherever boilers are not needed for parboiling operations, paddy husk can be burnt in a suitable 'heat exchanger' designed to produce clean hot air. This can bring in enormous dividends. Designs for this type of heat exchanger are under test now and will be released soon for commercial use. A standard unit for a 2T/hour mill will cost about Rs. 20,000/-. With such a unit in operation, large size boilers can be eliminated. Additionally, each mill can save about Rs. 200/- per day.

New methods of paddy preservation and dewatering are being tried out at the Thiruvarur Modern Rice Mills in Tamilnad and this along with husk fired heat exchangers can bring the drying costs to about $\frac{1}{3}$rd or $\frac{1}{4}$th of what they are now.

Topics for Future Study

In addition to the above suggestions, there are numerous other possibilities for future study and development in this field. Take for example the solar isolation in our tropical climate. We are receiving approximately 400 B.T.Us of energy per hour over each square

foot of area. When the sun shines bright, by deploying suitable reflectors or collecting device, can we not harness a sizeable part of the solar radiation over a given area ? Solar energy is being practically used by countries like France for producing very high temperatures in metallurgical operations. It is only a question of designing a suitable device for use in conjuction with a mechanical gain dryer so as to take maximum advantage of the natural heat. Such a design combines the cheapness of court yard drying with the advantages of a mechanical dryer. By coupling the device with automatic instrumentation, it can be easily ensured that the fuel supply is adequately increased when the sun shine decreases. Also by heating water by solar energy we can get over short cloudy periods and ensure uniform heating of air. This conserves fuel oil and contributes a great deal towards economy in rice processing. Such a device is under development and trial.

A few other areas of research that can contribute towards economy can be identified as pressure parboiling, high temperature drying, dielectric heating and so on. Conduction drying and sand heated parboiling are at present not quite popular. More work on these and similar types of study would need to be encouraged.

More information on all technical matters relating to the Rice Mill Programme and on specific methods of cost reduction in Rice Mills, can be obtained by writing to the Engineering Wing of the Department of Food (Rice Mill Project), Krishi Bhavan, New Delhi.

VIGOUR OF COMPUTER

By

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Historical Background :

Near about 1880-1890, Dr. Hermann Hollerith who was German origin, visited America, and during that time he had an opportunity to take an order from "Bureau of the Census" to construct a punching card (Lochkarten) machine.

Before 1900 the machine had been constructed and installated.

Than 1903 Dr. Hollerith left the "Bureau of the Census" and established a company whose name was "International Business Machine-Corporation."

In 1924 it was officially known as I.B.M.

In 1910 in Germany "Deutsche Hollerith-Maschinen Gesellschaft m.b.H (DEHO-MAG) was established.

After the World War II, the technical high school in München developed the machine PREM—(Programmgesteuerte elektronische rechnenanlagemaschin).

It was also found from the documents that the "Remington Rand" estab'ished Dr. Hollerith Association. Later "Remington" developed the computer.

There are so many computer engineering and machining companies established such as :

1) International Computing & Tabelling (I. C. T. English)
2) Bull Elektronic Company (Norway)
3) General Electric Company (U. S A.)
4) Remington Rand (U. S. A.)
5) Siemens & Co. (Germany)
6) Honeywell Regulator Co. (English)
7) National Cash Register Co. (U.S.A.)
8) Radio Corporation of America (U.S.A.)
9) I. B. M. (U.S.A.)
10) Zuse K. G. (Germany)

These are companies mostly advance developed and calculating automatic through programming system.

What is Computer :

It is an electro-mechanical combined mechanism system, which is regulated an automatic electronic system with high velocity. Most of the electronic computers are self operated by "Symbolic" through "digital" or analog methaden.

The "Symbolic" means, a conventional (Programme) method for a particular form or a particular number or a particular information.

As per example a number "3" is a symbol for the numeral quantity "3".

Also we can say that symbol is an information bearer of the machine for the operation of the programme.

And the "digital" is the help signal to convert into the symbol.

Therefore, those computer are operated symbol combination system, they follow two laws :—

1) Logic is for controlling result through "Flipflap" switch.

2) Arithmetic is for symboling operation, "Binax" "Decimal" or "Octal" and so on.

The "analog" is popular for an analog-calculating system, which is operated physical analog method with particular condition. And it's answer is developed by graphical form.

Technical Advantage & Disadvantage :— The computer machine may be used in "Science and Technology", "Management and Planning", "Commerce & Finance".

Through the computer, we can utilize such as, addition, subtraction, multiplication, division, comparing and put in order.

For operating the computer two things must be lookout, velocity and the workable position of the machine.

Therefore, the computer engineer should look after the followings :—

First :—Organisation and planning of the machine.

Second :—Programming of the machine.

Third :—Stand-by of the machine.

Fourth :—Operation of the machine.

As the monthly rent of the machine is very high, so management should not allow, the computer deparment stay idle.

Also, the management take consider the qualified trained people to put into the computer work, though it is a costly but it is necessary to gain in final stage.

Small quantity of work, for computer is unworthy (uneconomic) as it is highly velocity and high rent.

As per example :—

1) Indicating efficiency of magnet band (time)

$$= \frac{\text{Length}}{\text{Average velocity}}$$

$$= \frac{1100 \text{ (Meter)}}{500 \text{ (indicate/sec.)}}$$

$$= 2.2 \text{ sec.}$$

For practical error at list 20−30% must be added.

Therefore actual indicating efficiency (time) is, $= 2.2 + 0.7 = 2.9$ say 3 sec.

2) Time require for shorting machine

= Machine running time + Handle time

$$= \frac{Nc + nd}{s}$$

where :—

Nc = Total no-off shorting card (25000)

nd = Total no-off division in numerical shorting (4)

s = Velocity of the shorting machine (1000 card/min)

H = Handle time (25%)

∴ Time ref. for shorting

$$= \frac{25000 \times 4}{1000} = 100 \text{ min} + H$$

$$= 100 + 25 = 125 \text{ min.}$$

3) A computer machine whose velocity is 1000 printing/sec. What will be the operation time and cost of the 180 position.

If

s = Distance or removal

t = Operation time in sec. (Printing)

u = Initial velocity

v = Final velocity (1000/sec. printing)

f = Acceleration (constant)

$$\text{Average } S = \frac{u+v}{2} = \frac{1000}{2} = 500 \text{ removal/sec.}$$

Total removal is :— $500 \times 180 = 90000$

$500t = 90000$

∴ Time ref. for operation

$$= \frac{90000}{500} = 180 \text{ sec. or } 3 \text{ min.}$$

Operation Cost :— Effective time = 3 min

Arrangement time for operation	= 3 min
	6.0
Efficiency bar 10%	0.6
	6.6 min
	say − 7.0 min
Personal requirements 10%	0.7 min
	7.7 min
Overhead charge 100-200%	15.4 min
	23.1 min

If the rate of working hours DM 5/-

∴ 8.3 Pf/min

$23.1 \times 8.3 =$ DM 1.91 Pf.

∴ Total cost = DM 1.91

+ a) 25 min. Rent of the machine...

+ b) Material cost (Paper, cards etc.)...

Where :—DM = German Mark, Pf = German Pfenning

PLAN FOR CAPACITY DEMAND OF MATERIALS & COST OF RESPECTIVE AIRCRAFT

SHEET NO. .....

REPORT NO. ..... *DEPARTMENT* ..... *TEL* ..... *DATE* .....

PREPARED BY ..... *CHECKED BY* ..... *PASSED BY* .....

Code Nr.	Month	Art of Aircraft	Part of Aircraft or Organ	Classification of material I II III IV V	Plan No. & Plan Validity	Cost in DM.	Cost in % from previous year + —	Remarks
				1				
				2				
				3				
				4				
				5				
				6				
				7				

PROSPECTS FOR ACCELERATORS*

By

ACADEMICIAN ALEXANDER MINTZ, (Non-Member)

The dimensions of charged particle accelerators and their number is growing from year to year. Enrico Fermi once said jokingly that the growth of accelerators would stop only when their diameter reached that of the Earth. There are about 2,000 accelerators in the world today. The largest of them are the 70 Gev (1 Gev—1,000 million electron volts) proton accelerator in Serpukhov (the USSR, the 33 Gev accelerator in Brookhaven (the USA) and the 28 Gev CERN accelerator in Switzerland. An accelerator is in the pre-commissioning stage in Batavia (the USA), which will produce in the initial stage 200 Gev, and on the second stage 450-500 Gev.

In addition to traditional accelerators with fixed targets, there are installations which operate on colliding beams. These accelerators, despite a somewhat limited experiment programme, give the chance of investigating particle collisions, which otherwise would have required the construction of a conventional accelerator with the incomparably larger energy that is to be found in cosmic rays only.

A group of scientists in the USSR has developed the design of a new circular proton accelerator modification for 1.000 Gev. In the future, when changing from ordinary electric magnets over to superconducting magnets, it will be possible to boost this energy to 4,000-5,000 Gev. The orbit of this accelerator will reach 15.5 kilometers Such an accelerator, called "cybernetic" accelerator by its authors, will possess unique qualities. With the aid of a feedback system, the structure of the magnetic field is corrected automatically, depending on the position of the orbits which the particles travel. This allows to reduce the severe tolerances involved in the making and installation of magnets. All the processes of acceleration and experimenting are controlled by electronic computers.

At the USSR Academy of Sciences Radio-Engineering Institute in Moscow, a model of a 1-Gev accelerator was built in 1963-1967, which served for checking all the operating principles. The cybernetic principle allows to sharply reduce the weight and cost of the magnet, to cut its power supply, and to overcome the economic barrier in accelerator construction. The cybernetisation principle has already been applied to all the largest accelerators in the world.

Necessity

What are these extremely complex machines necessary for? Accelerators do not only contribute vastly to the development of fundamental research, allowing to study the tiniest elements of matter, but are also extensively used in various spheres of science, technology and public health. Here are but a few examples.

Accelerators are made increasing use of for the non-destructive testing of materials. This

* Received by Courtesy of Information Department of the USSR Embassy in India.

level. Several standard associations have been recommended the following standards for transformers' sound levels :—

Kva	Sound level in decibels
0-5	40
6-9	40
10-25	45
26-50	45
51-150	50
151-225	55
226-300	55
301-500	60

To-day most of the transformer manufacturers in the U.S.A , have been adopted these standards or adjusted close to these standards. Some of them already recommended average sound levels for dry and liquid type transformers which are little below than the standards of the American Standard Association.

Beside the standards, mounting of transformer is also important. The vibration generates within the steel core of the transformers, transmits to the structural frames of the building, which increases decibels. Mount small transformers on heavy cemented brick walls, on thick reinforced concrete walls or floors. Big transformers can be mounted on factory built iron frame which can be installed on heavy concrete pad either in indoor or outdoor locations. Flexible mounting is highly recommended when transformer has to mount on structural frame within an area where ambient sound level is very low.

Generally for big transformer ask the manufacturer to provide built-in vibration isolators. At the time of installation use flexible couplings to conduits and flexible conductors connected between transformer and other equipment or structures to reduce the transmission body to other equipment or structures.

The sound reflection in a location where the transformer is to be installed, should also be considered. If you stand in the middle of an empty hall and talk, you will hear the reflection of the sound generated by your voice less than the reflection of same sound generated by your voice if you stand at the corner of the hall where corner of the wall and ceiling acts as a megaphone. Don't install transformers at corner unless you have real space-problem. Also avoid barriers close to transformers which helps to increase the sound levels.

If you consider the above mentioned factors prior to transformer installation, the humming noise of transformer will never bother you. If you have no problem for space, install transformer in a closet, vault, behind a wall or in a room without windows and light wood or metal door.

Average ambient sound levels for typical locations can be considered to select the sound levels of transformers quickly —

Big factory : 75 to 90 db.

Small factory : 60 to 75 db.

Office with several machines as typewriters, adding machines, computer etc. 60 to 75 db.

Office without machines : 50 to 65 db.

Average home : 30 to 42 db.

The above figures are based on our long experiences for selection of transformers' sound levels for several projeets.

SOUND LEVEL IN TRANSFORMER

By

HEM CHANDRA CHATTERJEE

M.I.E.E.E. (U.S.A), M.I.E.S. (U.S.A), M.S.W.A. (Canada), M.C.I.M. (Canada), VDE (West Germany), Dip. B.I.E.T. (London), Dip. Indust. Management (Canada , Dip. P.E. (Philadelphia), Cert. Elect. Eng'g. (Univ. of Pennsylvania), M.I.S.E., A.M.I.T.E., Chief Electrical Engineer, Vinokur-Pace Engineering Services Inc., Philadelphia U.S.A.

Each transformers makes some sound whether it is a small transformer like 5Kva or giant one like 5000 Kva. The simple cause is the vibration which generates sounds within the magnetic steel core. In one location the humming noise of transformer may bother you too much, but in other locations the humming noise of the transformer may not bother you. What's the reason ? The reason is the "ambient sound level." Let me give you an example to clear more about ambient sound level. Go to the side of a crowded street and drop a naya paise exactly the same time when a tram car is passing you. You didn't hear the sound of the naya paise when it stuck on the footpath although it did make a sound. Here, again the reason is the ambient sound level—the combined sounds surrounding the area are generated by different sources.

The same principle is applicable to the sound level of transformer. The unit for measuring the loudness of sound is called decibels (db). Suppose 40 db sound rated transformer has been installed in your small factory where the ambient sound level is 60 db due to generated noise of production machineries and other. The transformer would not bother you. But if this transformer is installed inside in your office area where you maintain a low ambient sound level, approximate 30 db or less, it would bother you. If you stay in the same office at night, when the outside ambient sound level drops, it will bother you more.

According to independent laboratory test the combined sound level of three similar transformers will be 4.8 db higher than each transformer's sound level. Suppose three transformers 30 Kva each with 35 db sound level mounted somewhere in your factory, will generate 39.8 db combined sound level. Two transformers with equal sound levels mounted side-by-side, will generate a combined sound level only 3 db higher than their individual level.

Most of the transformer manufacturers recommend a sound level chart for better application. A transformer should be selected below the ambient sound level of the area or room where it will be installed. Therefore, when you buy a transfoamer, first find the location and the ambient sound level. Take the help of the manufacturer to get the ambient sound level or follow the standard recommended chart. Standard associations in most of the countries have the charts and graphs for guides. Also major transformer manufacturers provides recommended decibles

The programme setter will take the data from the material plan and set-up the computer programme.

After completing the programme, it is to be printed in the computer paper than distributed in the respective departments or persons.

Management in Computer :—

We know the computer in the management may use in various fields (Manufacturing, scheduling, payroll, accounting, costing and the market-analysing etc.).

Before come to the computer stage, all general managers or managements are depended in four classical factors.

1) Market forecasting.
2) Histroical background in the particular branches.
3) Estimating (including production time).
4) And the capital appropriations (involve the strategy of growth for the business .

All these random data put into the computer for geting on appropriate result which is essential for manager to decide and performance his business.

Therefore, all managers or his associates should also know about the "Critical path method" (CPM), "programme evaluation and review time" (PERT), and risk analysis (RISKAN) system.

So scientific business management is a vital factor of full benefit and realized the capital and industrial field.

Conclusion :—

Though I am not a master of computer but I have a right to offer my comments. It is a costlier affair between human and technic.

Therefore, management should not allow mismatch between computer and its worker's. Computer is the latest developed of the significant of the technic in our industriai society. Many people say computer is a immoral in the working field.

I like to ask that gentleman what is moral and what is immoral ? Do we observe all moral things ? For developing economic and social welfare we can neglect science and technic.

Literature :—

1) Einführung in the Elektronische Datenverarbeitung by Ned Chapin.
2) Computers & Management by the Leatherbee lectures (Harvard Business School).
3) Verein Deutscher Ingenieure-Zeitschrift.

applies to X-ray and gamma-spectroscopy (for instance, checking of gasand oil-pipeline welds) and thickness gauges (which allow to measure with the aid of protons the thickness of a graphite layer with a very high degree of precision). The radiation treatment of materials is used to harden them, to raise their fusing point, and for other purposes. Radiation hardening of various coatings, especially of plastics, is quite a promising trend with great economic prospects.

Accelerators led to the evolution of nuclear medicine and radiation therapy Radioisotopes, most of which were discovered with accelerators, are extensively used for diagnostics in the examination of blood, thyroid gland functions, the functions of the kidneys and lever, for oncological research, etc. The use of the iodine—123 isotope, instead of the iodine—131 isotope, allows to reduce the patient's radiation dose to a hundredth, because the former does not emit electrons and has a shorter lifetime. Preliminary data show that the zinc-72 isotope produced on accelerators may be used as a simple means for the early and mass diagnosis of prostate gland cancer.

Treating malignant tumours is, probably, among the most important fields of accelerator application. Proton beams are now used for this purpose. Successful work in this sphere, highly appreciated abroad too, is conducted on the external beams of the JNRI synchrocyclotron (Dubna) and on the 7 Gev proton accelerator at the Institute of Theoretical and Experimental Physics in Moscow. Promising results have been produced in diagnosing and treating malignant tumours by secondary pi-mesons and mu-mesons.

Accelerators are also used for sterilising and preserving foodstuffs : plans are made for using them to sterilising sewarage. Charged particles may be successfully used as a biological research instrument, for instance, for observing the processes taking place in the cell.

Last but not least, the use of accelerators promotes international cooperation. Physicists from various countries work on joint problems, and in the nearest future international groups of scientists, designers, builders and experimentors may be set up. This will allow to disclose still quicker the mysteries of the structure of matters.

Notes & News

India's first —Low Voltage Switchgear Testing Laboratory. India's first low voltage switchgear testing laboratory, lately, commissioned in Bangalore, fulfils the need for a central organisation of applied research to resolve the intricate problems pertaining to generation, transmission and distribution of power currently being encountered by supply undertakings and electrical manufacturing industries.

The laboratory enables prototype testing and development of low volage switchgear and fusegear. The generator for testing low voltage switchgear and fusegear is of 50 MVA capacity and will help developing and improv-

ing designs for the electrical manufacturing units.

Established through collaboration between the Central Water and Power Commission and the UNESCO as the participating and executing agency, the project has cost about Rs 4.5 crores.

The laboratory under the Bangalore-Bhopal complex of Central Power Research Institute functions in technical collaboration with the Indian Institute of Science and the Bhopal unit of the Heavy Electricals Ltd., in order to ensure that the available resources are pooled and used for the maximum advantage.

The research and testing centre at Bangalore includes laboratories for testing solid insulating materials, measurement of physical and chemical properties of liquids, high voltage equipment and model towers.

Volatile Fungal Inhibitive Paper. Under the tropical climatic conditions prevalent in most parts of our country, service equipments and stores like leather goods, tentage, textiles, parachutes, optical and electronic equipments, armaments, rubber goods, PVC maps and photographs of strategic importance suffer microbiological deterioration during storage or transit. Many of these items are either completely lost or suffer impairment in their performance properties due to microbial damage.

The Volatile Fungal Inhibitive (VFI) Paper developed at Defence Research Laboratory (Materials), Kanpur when used as a wrapper for equipments and stores prevents microbial growth and consequent damage. The VFI paper slowly emits fungicidal vapours which penetrate even the most intricate and inaccessible parts of the equipment and effectively inhibit microbial growth. For developing this useful defence item, the Inventions Promotion Board has awarded Rs. 1,000 each to Dr. J. N. Nanda and Sarvashri H. M. Dayal and P. N. Aggarwal, Scientists of the Laboratory.

Two different types of VFI Papers—Kraft paper and Tissue paper—have been developed. The VFI Kraft paper is meant for packing heavy stores and materials like electronic components, textiles, tentage and armaments, while the VFI Tissue paper is used for optical instruments, parachutes and finished leather goods etc.

Besides being of Defence interest, the VFI paper is also of immense value to trade and industry. It has often been observed that large consignments of Indian exports like finished leather goods and textiles develop fungal growth, leading to ther rejection by the importing countries The use of VFI paper for packaging export consignments can prevent huge losses to the industry and also the country.

The VFI paper is easy to prepare and the ingredients used are available indigenously. The laboratory cost of production of VFI Kraft and VFI Tissue papers is Rs. 1.20 and Rs. 1.06 per sq. meter respectively. Large scale production is likely to reduce this cost considerably. The National Research Development Corporation, New Delhi has granted licenses to a number of firms for commercial exploitation of VFI paper.

Water Filter Candle (CGCRI, Calcutta). Ceramic water filter candles are extensively used for obtaining filtered drinking water free from both suspended impurities and harmful

water-borne bacteria such as those of cholera, dysentry, typhoid etc. These candles, imported under the trade name 'Berkfield' filter candles, are made from kieselguhr, a special type of cellular silica which has not so far been reported to be available in the country in commercial quantity.

The total annual consumption of filter candles in the country is over one lakh pieces valued at Rs. 15 to 20 lakhs in foreign exchange. The market price of such candles ranges between Rs. 25/- to Rs. 90/- per piece. The life of these candles is reported to be 2 to 3 years for filtering the average quality water.

The Central Glass & Ceramic Research Institute, Calcutta has developed a process for making these candles out of indigenously available common ceramic raw materials without incorporating kieselguhr.

The manufacturing cost of the 'Berkfield' type indigenous filter candles would be about Rs. 3 per piece according to the Institute's estimate, while the cost of imported candles is about Rs. 15 each. Several batches of commercial size candles made at the Institute were tested for their quality at the Indian Institute of Hygiene and Public Health, Calcutta Indian Institute of Experimental Medicine, Calcutta and two other institutes and their rate of filtration and capacity of filter water free from bacteriological contamination were found to be highly satisfactory. These candles are capable of filtering water clear and free from bacteria, irrespective of the source of supply.

Electrochemical Marking of Metals. This method is of considerable use for transferring letters, designs and numbers to metals so that metal articles of industry and commerce are marked for the purpose of identification, cetification of quality and for advertisement. The method has the advantages of speed, clarity, permanence, ease of production and of causing negligible damage to the underlying metals.

With a view to developing know-how and to designing equipment required for electrochemical marking of the metals, investigations were undertaken by the Central Electrochemical Research Institute (CECRI), Karaikudi. The work involved : (i) design of a suitable pad with electrodes to hold electrolytes and capable of carrying the required density of current ; (ii) use of a suitable combination of electrolytes and additives to effect the rapid etch and/or deposit of the metal ; and (iii) design of a suitable stencilling device.

The process has been studied on a laboratory scale. Metals marked by the method developed by CECRI have been approved by several firms.

Sodium chloride, boric acid, sodium hydroxide, potassium dichromate, benzoic acid, polyvinyl alcohol, ferric chloride and tartaric acid are the main raw materials needed in the process.

The essential items of plant and machinery are : transformer for ac markings, rectifier for dc markings, ac or dc meter, electrode holder, and an electrical tuning device.

It would be possible by the use of the above equipment to carry out marking operations over an area of 10-20 cm^2 of the metal.

The total capital outlay for putting up a metal marking unit capable of producing 1,50,000 markings per year has been estimated at Rs 5700. The cost of marking an area of 20 cm^2 has been estimated at about 11 paise.

Society Notes

Shri P. C. MITRA, F.I.S.E. (Hon.) FELICITATED

Welcoming Shri P. C Mitra, B.Sc (Glasgow), F. I. Mech. E. (London), Special Officer, Calcutta Port Commissioners, as the newly elected Honorary Fellow of the India Society of Engineers, a felicitation Tea-Meet was held at Firpo's on April 8, 1972. Shri L. P. Molnar, Fellow and one of the Vice-Presidents of the Society, who was the host-in-chief on behalf of the Society's Executive Committee, paid tribute to the accomplishments of Shri Mitra and introduced him to other distinguished guest to the get-together. Shri U. P. Mullick, the President of the Society, delivered a highly informative Address of Welcome. Shri Mitra in his reply speech thanked the Society and its office bearers for the honour shown to him and also dwelt on the varied technical problems of the Calcutta Port in the context of the technological needs of the country under developing economy. The Vote of Thanks to Shri Mitra and all other guests gracing the get-together was moved by Shri Raj Krishna Banerjea, General Secretary of the Society.

ADDRESS OF WELCOME
By
SHRI U. P. MULLICK

Shri P. C. Mitra, Friends and Gentlemen,

I have great pleasure in welcoming Shri P. C. Mitra to this Tea-Meet of our India Society of Engineers. Our Society is one of the oldest Engineering Societies of India with membership spread all over the world. It is only in the fitness of things that we shall utilise this forum of Tea-Meet in the Maharaja in honour of Shri Mitra, one of the greatest sons and a most distinguished Engineer of India.

I specially announce that this India Society of Engineers in a resolution of the Executive Committee held on 29th March 1972 has conferred on Shri Mitra our highest honour the Honorary Fellowship of our Society. We hope at a Special Conference later on we shall formally bestow upon Shri Mitra our Diploma of Honorary Fellowship of the Society.

As Shri L. P. Molnar, our distinguished colleague, in his inimitable way has already told you, Shri Mitra was till recently the Chief Mechanical Engineer of the Calcutta Port Commissioners, with a most distinguished record of service to the country. As a Special Officer he is now on Special Duty preparatory to his taking over as the Seniormost Officer of the Port Commissioners, the Deputy Chairmanship of the Calcutta Port Commissioners.

Gentlemen, and our honoured guest Shri Mitra, we all know the privileged position that Calcutta Port occupies in the Port handling and berthing operations in the import and export trade of India. In modern economy Ports are indispensable for international trade and industrial development which bring socio-economic progress and prosperity to areas they serve. In a large

Port like Calcutta, besides the traditional industries like shipbuilding and ship repairing, a host of other industries can grow up round the Port, which can turn the Port into a hub of real industrial centre.

Considerable importance is therefore attached to the Calcutta-Haldia Port Complex by enlarging the Port area operations of the Main Calcutta Port, and extending its operations to a subsidiary Port at Haldia 30 to 40 miles down stream on the Hooghly. Therefore in the design of the Calcutta-Haldia Port Complex it is in the fitness of things that not only there has been concentration of attention on Cargo handling, but also due attention is being paid to available land area around the Port Complex where Port related industries can be established.

Since his taking over charges on West Bengal, our respected Governor Shri A. L. Dias, and also our present Chief Minister Shri Siddharta Sankar Ray have been taking keen interest in the development of the Calcutta-Haldia Port Complex. But at this hour when the progress of the Port Complex is set for a rapid development, we must not forget Shri B. B. Ghose, the pioneer who laid the foundation for the Haldia developments, and to whose memory we shall accord a befitting honour on another special occassion.

We must also recognise in regard to the Port Complex developments the great responsibility that devolved on Shri K. K. Ray, Chirman, Calcutta Port Commissioners, and on the Commisioners, and on Shri K. N. Sen, Chief Engineer, Haldia Dock Project, on Shri S. K. Bose, Deputy Mechanical Engineer, Haldia Dock Project, on Shri B. R. Chatterjee, Deputy Chief Mechanical Engineer, Haldia Dock Project, on Shri A. N. Biswas, Senior Scientific Officer, Hydraulic Study Department, Calcutta Port Commissioners, and more particularly on Shri P. C. Mitra, lately Chief Mechanical Engineer, Calcutta Port Commissioners our present honoured Guest.

The Master Plan for immediate and long term development of Haldia was prepared in 1962, and the Hydraulic Study Department was set up by the Commissioners to carry out studies on the River Hooghly with particular reference to the stability and improvement of the various channels in the estuaries as well as the Haldia channel. The Government of India also decided to construct the Furrakka Barrage now nearing completion, so as to supply 40,000 cusecs of perennial salt-free flushing water into the River Hooghly. A Port Traffic Study Team was appointed by the Government of India in 1964, who submitted their Report in August 1965. The Report revealed that total traffic through all major ports was likely to be of the order of 80 million tonnes in 1970-71, and 116 million tonnes by 1975-76, as against 45 million tonnes in 1962-63.

It has been estimated that the share of Calcutta-Haldia Port Complex will be about 20 million tonnes in 1970-71, 29 million tonnes by 1975-76 and 45 million tonnes by 1985-86, against 9.97 million tonnes in 1966-67. Haldia's share of Cargo by 1975-76 is estimated will be about 21 million tonnes and 3.7 million tonnes by 1985-86.

Dr. Bhatia, Director Transport Research, Ministry of Transport, Government of India, has estimated that the Calcutta-Haldia Port

Complex's traffic by 1985-86 will be crude 6.0 million tonnes, POL products 2.97 millon tonnes, Fertilisers (Phosphates, Potash) and Sulphur 8.32 million tonnes, Liquid Chemical 0.16 million tonnes, coal 12.8 million tonnes, Iron ore 5.0 million tonnes, Iron & Steel 3.15 million tonnes, Machinery 0.71 million tonnes, other General Cargo 4.19 million tonnes, and aggregating in all 45 01 million tonnes.

The berthing facilities at Haldia for the first phase development of the Port and Dock system provides for one coal berth, one iron ore berth, one rock phosphate berth, one Heavy Lift-cum-container berth, one Grain and General Cargo berth, one Finger Jetty, and one oil berth.

The land use for Haldia Dock system provides out of an acquisition of 17½ sq. miles, 5 sq. miles (3300 acres) for the Dock system including Railway Marshalling yard, 4 sq. miles (2652 acres) for leasing out to Refinery, Fertiliser, Petrochemical Complexes (350 acres for Refinery, 540 acres for Haldia Fertilisers and 1200 acres earmarked for Petrochemicals, and remaining 300 acres for medium, and small and ancillary industries), 1.25 sq. miles (800 acres) for Port Administrative offices, Central and State offices, and Commercial Establishments, 2 sq. miles (1200 acres) for Rownships and remaining 1 sq. mile (650 acres) for extending the Railway system upto Haldia Station, and for 'Char' land.

In the sector covering the future development of the Dock system 200 acres, I understand, have been set apart for establishment of export oriented industries.

In regard to the utility services, the Geological Survey of India studies reveal that the underground acquifer can supply 25 mgd. of water tapped by 900/1000 ft. deep tube wells sunk 1500/2000 ft apart. The acquifer between Panskura and Chaitanyapur at a depth of 500 600 ft. can also largely meet any slootfall of water in Haldia area.

The Technical Committee of the Government of India, estimated the demand for water in Haldia Region at 50 mgd in 1982, 100 mgd in 1995, and 240 mgd by 2070. The Committee has recommended use of river water from Uluberia, 30 miles upstream of Haldia, and in 2 phases at 45 mgd each at a total expenditure of Rs 26 crores.

The West Bengal State Electricity Board has extended their power grid to Haldia through 33 Kv. line. The Board is also understood to be going ahead to sugply power from Santaldih and extend their substation at Haldia so as to supply power at 132 Kv. They also propose to change the power grid to 220 Kv, and extend the DVC to Haldia, and to set up a Thermal Power Plant either at Kolaghat or at Haldia, to meet the demand of Haldia Region beyond 100 MVA.

The rail-link between Panskura and Durgachuck located at N.E corner of the Haldia Port was commissioned in January 1969, to which are now linked up the internal Part of the Railway system. For road communication Haldia Port is to be connected by a Highway (NH. 41) with Calcutta-Bombay National Highway (NH. 6) at Mechada. The existing DB Road between Panskura/ Mechada and the site has also been strengthened.

The Haldia Dock system provides, I understand, for 2 Lock 34 berths (6 Bulk and 28 General Cargo berths,) and 2 Dry Docks.

I understand the coal berth for 80,000 DWT will be equipped with a fully mechanical handling Plant having an assured load capacity of 5000 tonnes/hour to be increased to 8000 tonnes/hour later. The Plant, I understand will be capable of loading 60,000 DWT Ore carriers in 10/12 hours, this enabling the ships to leave Port in 24 hours. The Coal berth for 60,000 DWT will also be equipped with mechanical handling plants of an assured loading capacity of 1800 tonnes/hour. The annual throughput of the ore berth will be 10/12 million tonnes, and that of Coal berth 5/5 million tonnes. Provision is understood to have been kept for a second mechanical Ore and Coal berth.

The Phospate Berth for 60,000 DWT, I understand, will be fitted with a continuous unleader, and a Grab crane having an assured unloading capacity of 1000 tonnes/hour. The Berth will also have 30,000 tonnes of storage shed with a conveyor system for onward movement of cargo to the consuming points, either by road or by rail.

The Finger Jetty will be equipped with a Gentry Crane and conveyor system to transport Cargo from higger slips to smaller ships, or from a ship to a barge or vice versa.

The Container handling facilities will comprise of a Heavy Liftcum-container berth which will have a 30 ton portainer crane on the quay manufactured by M/s Braithwaite & Co. (India) Ld. in collaboration with PACECO of USA. There will be a back up yard of 18 acres, where a Container Marshalling yard, I understand, will be located. The yard with storage space for 1500 Containers will be equipped with high speed 30 tonnes Transtainer cranes rail mounted, for handling both road and rail borne containers.

The Open General Cargo will be handled by high speed quay cranes. There will, I understand, the 2 General Cargo berths of 720 ft x 120 ft wide and a back up area of 18 acres equipped with rail mounted cranes.

The Oil Jetty was put in commission in 1968. The Jetty originally designed to handle ships of 40,000 DWT, I understand, is now being modified to handle ships drawing a draught of 40/42 ft. When fully modified, the Jetty will be able to handle upto 80,000 DWT tankers. The Jetty has also a Hose handling Rin also manufactured by M/s Braithwaite & Co. (India) Ltd. for first time in India, for facility of quick handling of big hoses.

It is happy to note that 65% of the civil works of the Lock gates have been completed. Orders for 3 sliding gates of the Lock have been placed with M/s Jessops & Co. Ltd. Three 50,000 gpm impounding pumps are being manufactured by M/s Flowmore Private Ltd. The Radial Gates and Pen stocks of the impounding culverts are being manufactured by M/s Tribeni Structurals Ltd.

The Traffic estimates for 1880-81 are Iron Ore 35.0 million tonnes. Rock Phosphates 7.5 million tonnes, Mineral Oil (imports) 20.0 million tonnes, Rice 2.0 million tonnes, other cargoes 21.5 million tonnes, Dry cargoes 3.25 million tonnes, and mineral oil 3.0 million tonnes.

Some of the important cargo handling equipments, I understand, will include complete 6000 TPH ship loader equipments for iron ore, 1000 TPH stacker-cum-reclaimers for coal, and continuous SKT unloaders for Phosphate handling. The 30 ton Portainer crane will handle a container in and out of ship in a 2 minute cycle, and backed by Transtainer

and other mechanical equipments will be able to handle modern 'cellular' container ships.

In all these scope of development of indigenous resources is very great, foreign exchange requirments estimated being about Rs. 7 crores only. Thus in conception, gestation and growth, the Haldia Project is expected to be entirely Indian.

Our honourable Guest Shri P. C. Mitra has estimated that on the basis of 50% share for Indian ships in carrying cargoes to and from Indian Ports, 18 Indian ships of 60,000 DWT carriers will be needed by 1980-81 to serve the ore trade alone from the Indian Ports. Total ships required for Ore traffic will thus be around 36 carriers of 60,000 DWT, and Calcutta-Haldia Complex's share can be expected to be about 50%, namely 18 ships on a rotating traffic.

The enormity and Port handling capacity can thus be realised for the Calcutta-Haldia Port Complex in the coming years, which will be required to handle upto 80,000 DWT ships of even upto 45 feet draught.

While the Haldia Port and Dock Project provides for a sufficient good draught, the prob'em of maintaining navigability and adequate pilot service up to Calcutta Port, and handling bars like Balari and other 14 bars, and the tortuous bends, necessity for constant dredging, and meeting problems of bore tides and bore silts, and lighthouse arrangements, are continuous problems for which the responsibility of the Calcutta Port Commission will be enormously increased in the coming years. Due to heavy silting and bars, the Calcutta Port's handling of 11.5 million tonnes a year in recent years has come down to as low a figure as 6.5 million tonnes a year, a year or two back, as ships of 11,000/12,000 DWT that normally call at Calcutta Port can carry only half the load due to shallowness of the Hooghly bed, resulting in increased freight charges. Besides 17 days required for turnig a ship has also caused heavier freight charges. Hence the number of ships recently calling at Calcutta Port has been steadily falling off.

It has therefore been nesessary to design the auxiliary Port at Haldia so that all the year round deep draught navigability can be maintained. Truly therefore it can be said that Calcutta-Haldia Port Complex will be one of the biggest Port Complex East of the Suez, and will be the heart of Eastern India's trade (export and import) and industry.

Sir, it is such a Port Complex, which is designed to give a turn around of ships in 2/3 days in place of present 17 days, and all the year round draught of 42 to 45 feet, of which you are to act as the Deputy Chairman, and I believe the Government of India has selected the very right man at this hour, who can with his vast experience and efficiency handle efficiently and put through the complete Port Complex Project Scheme in the speediest and ablest manner.

On behalf of this Society I congratulate you, Sir, on your selection to this very important and onerous position, and I have the utmost pleasure to welcome you in our midst, as one who will put many milestones right ahead for us in the coming years, nay months, to put India on a rapid march to industrial progress and prosperity, and to give work to India's many millions.

SCIENCE AND ENGINEERING

JOURNAL OF THE INDIA SOCIETY OF ENGINEERS

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SCIENCE & ENGINEERING

(JOURNAL OF THE INDIA SOCIETY OF ENGINEERS)

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PORCELAIN TABLE WARE INDUSTRY

The use of table ware in India has now been extended even to the remotest villages. Indian people are gradually becoming more crockery minded, because it is hygenic and cheaper. It is therefore expected that demand of crockery ware will increase very greatly in future because of the change in habit of the people that is going on in the use of crockery ware in place of brass ware and metal utensils.

The per capita consumption of Tableware is about 1.37 Kg/Capita/year in Japan, 0.50 Kg/Capita/year/in South East Asia, Middle East and Near East countries and barely 0.049 Kg/Capita/year in India. Thus Japan's annual consumption of Tableware is about 28 times that of India per capita. Hence the present production of Tableware in India can safely go up upto 10 times.

Consumption of Tableware in India from 1967 to 1971 shows that whereas in 1967 against a population of 506.4 millions, per capita annual consumption and tonnage were 0.069 Kg. and 33,422 tonnes, in 1971 against a population of 566.7 millions, the figures have gone upto 0.097 Kg/capita and 54,000 tonnes. Hence there is a huge potentiality in the Tableware Industry in India.

The basic raw materials for the industry are China Clay, Quartz, Felspar, Fireclay, Ball Clay, and auxiliary raw materials are Gypsum plaster, Alumina, Sodium silicate, Talcum glaze, all available within the country. Again out of above Bihar State can provide 45% of China Clay, 11.1% of Quartz, and 36.4% of Fireclay in terms of all India total.

For a Tableware industry unit producing 3,000 tonnes of product per annum, the requirement of Electricity is about 1,440,000 Kwh and of water 234 M^3/day. These are not excessive. To maintain uniform temperature in firing and to maintain heat efficiency, tunnel kilns are generally used by the industry.

Japan is naturally a leading manufacturer and exporter of porcelain Tableware. Since many years they have been exporting porcelain Tableware and Refractory bricks to countries like U.S.A., South East Asia, Middle East Asia and Africa. Recently M/s. Japan Engineering Co. Ltd., have carried out a feasibility survey for ceramic plant in Bihar, India for the Government of Bihar.

It may be mentioned that Porcelain wares, Earthen wares and Stone wares are produced from the same basic and auxiliary raw materials. However no attempt has been made in India so far to produce porcelain Tablewares which are decidedly superior in quality to Earthen wares and Stone wares. The particular qualities that attract attention for porcelain ware are immense lightness, hardness, brilliant whiteness and translucency. Naturally they are also eminently suitable as Hotels wares. Besides the 5 Five Star Hotels in existence, 10 more Five Star Hotels are coming into existence, besides numerous Four Star & Three Star Hotels in India.

Some time by end of 1966 Chemicals and Allied Products Export Promotion Council—a Government of India undertaking—sponsored a Trade delegation to pay visits to countries in South West Asia to explore market for Ceramic goods and Crockery wares. Their exhaustive report has since been published suggesting favourable export possibilities to these countries.

It is in the above light heartening to find that the foundation stone will be laid shortly by the Governor of Bihar for a 3,000 tonnes/annum Porcelain Tableware Project at Getalsud, Ranchi and that the Company concerned M/s. Nalanda Ceramic & Industries Ltd., are pushing ahead with their new project work with Japanese Collaboration.

PRODUCTION OF SYNTHETIC RUBBER IN INDIA

By
U. P. MULLICK (M)

Synopsis

India produces about 90,000 tonnes of natural rubber and output may increase to 120,000 tonnes in 1980. The total rubber demand by that time may be as high as 300,000 tonnes a year, and this has to be met by increased production of synthetic rubber.

The production of natural rubber in India is at present about 90,000 tonnes annually. This output, it is estimated, is likely to increase to 120,000 tonnes a year by 1980. However the total demand for rubber in India by 1980 is estimated at 300,000 tonnes a year. Hence there is no alternative but to meet this demand by increased production of synthetic rubber.

The consumption of rubber would naturally be dependent on the availability of natural rubber and on the ratio of natural rubber to synthetic rubber (NR : SR) in different uses. It is expected the total consumption of rubber will be of the order of about 175,000 tonnes by the end of 1973-74 period. On the assumption of a compounded 10% growth, the requirement by the end of 1978-79 will approximate 284,000 tonnes, and by 1980, 300,000 tonnes.

The synthetic rubber requirements in 1978-79 therefore, according to the present status of rubber plantations in the country, would be of the order of 120,000 tonnes on the basis of availability of 180,000 tonnes of natural rubber. At the present moment there in only one unit producing SBR. The Koyali Unit is expected to include a production programme of 20,000 tonnes of Poly Butadiene rubber. In view of the fact that the rubber processing industry is very concentrated in Eastern India, which is very far away from the plantation region, it is desirable to include a range of synthetic rubber materials at Haldia. At least 3 units are envisaged—one for SBR, one for butyl rubber and one for EPT rubber with 20,000 tonnes annual capacity. The earlier petrochemical plan prepared by the Planning Group also included EPT.

EPT

Ethylene Propylene Ter-polymer (EPT) with the third 'cyclic' or 'acylic' monomar is now replacing Butadiene rubber in certain automobile and other uses, particularly for its weather-stripping properties. In the United States, EPT has found wider applications in high voltage cable coatings. Considerable amount of development work is now under way in that country. It is expected that in the near future, EPT will be considered as a general purpose rubber and can be used in tyres—being a cheaper material originating from cheap ethylene-propylene from Naptha Crackers. Ethylene-Propylene co-polymers, owing to their interesting visco-elastic properties, excellent resistance to ageing, air and chemicals, and low price of the starting materials, look particularly promising.

The total synthetic rubber production, estimated at 65,000 for 1973-74 can have the

economics of the complex improved considerably if the B-B (Butadiene-Butyl) fraction, after extracting Butadiene, can be used as chemical materials which can also be developed in the course of the next few years. All spent B-B fractions after extracting Butadiene can have a large demand, and the production of Isobutylene from B-B spent fractions can however be utilised for Butyl Rubber.

Newer Rubbers

Because of the technical limitations of SBR, manufacture of newer rubbers like Polybutadiene (PB), Polyisoprene (PI)., Ethylene-Propylene Terpolymers, (EPT) is being seriously considered, besides production of specially rubbers like Butyl, Nitrile and Neoprene.

Since many of India's rubber processing industries are located in West Bengal, the demand of these units should receive high priority while deciding on the type of synthetic rubber to be manufactured, based on Haldia feed stock. Petrochemicals Committee envisaged the production of 20,000 tonnes of EPT Rubber at Haldia. EPT rubber cannot be considered useful for passenger cars and truck tyres, nor for tubes, which together cover the major share of the rubber use. Hence, it appears prudent to limit the production capacity to about 5,000 tonnes for speciality rubber products like automotive mountings. Manufacture of Cis 1, 4 polyisoprene should be more advantageous considering its capability of replacing natural rubber for many uses. Propylene dimarisation process may be used for manufacturing Isoprene and an initial capacity of 15,000 tonnes may be considered. The comparative economics for producing Isoprene methanol using methanol from the complex production or from the proposed FCI plant, and Isoprene from LPG available from refinery or cracker can be considered.

Considering all the above, a maximum of 20,000 tonnes/A of EPT (preferably lower), 12,000 to 20,000 tonnes/P A of Butadiene B-B, 15,000 tonnes/A of Butyl rubber from B-B (Butane-Butylene) fraction, upto 30,000 tonnes/A of SBR rubber from Butadiene, and 7000 tonnes/P A of polybutadiene production at Haldia cad be considered.

The installed capacity for Butadiene (69/70) is 30,000 T/A, while projected demand for 1973-74 is 52,000 T/A Major products being synthetic rubber, capacity installed in India is 30,000 T/A (69-70) and projected demand for 1973-74 is 60,000 T/A according to estimates.

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"SCIENCE & ENGINEERING"

WATER MANAGEMENT UNDER THE COMMAND OF MAJOR IRRIGATION PROJECTS

By

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The construction of Major Irrigation works is, no doubt, a complicated affair, but the proper distribution of water thereunder, appears to be more complicated and challenging, since it involves a variety of factors. One has to deal with thousands of individuals of different interests. It is in this respect, that the management of irrigation water presents a challenging problem to the Engineer. The subject of water management does not merely deal with the proper distribution of water but also includes efficient and economic use of water, land development, water logging, land reclamation, training and research, and a variety of related problems which have direct and indirect bearing on the subject.

Distribution of Water

From the experince gained in the management of distribution of irrigation water under the command of Ghataprabha Project, Tungabhadra Project, Krishnarajasagar Reservoir Project and other smaller projects in the State, the most formidable difficulty appears to lie in the equitable distribution of water. It is common experience, that areas located in the higher reaches of the canal get plentiful supply of water and those located in the tail end reaches are denied this facitity. The water supply in the tail end reaches is very meagre and insufficient for the healthy growth of crops. This happens on account of the wasteful methods of irrigation practised in the higher reaches and also due to the greediness of the cultivator to take more water to his lands. This state of affairs must be remedied by satisfactory methods whereby the entire command is supplied with reasonable and equitable distribution of water. A great percentage of the command under major projects normally consists of semi-dry crops either Kharif or Rabi. The delta assumed for such crops would be small ranging from 25" to 40" depending upon the nature of the crops, distribution of rainfall in the area and also type of soil in the command. Assuming an average base period of 120 days, the command would get a depth of 2" to 3" of water in 10 days. This would suggest that water could be given by rotation once in 10 days, each watering being limited to 2 to 3 inches. The hybrid varieties appear to need a little more frequent watering than the ordinary Kharif crops, such as Maize, Jowar etc. Apart from this, the problem of rotation of water by itself has presented considerable difficulty, since the given amount of water has to be distributed over a specified area so that the depth of water is about 2" to 3" uniformly. In order to effectively implement this rotation, different patterns of irrigation management staff are prevalent in different areas. In the Bombay Karnatak area, the Patkari is the most immediate person with respect to the cultiva-

tor for the distribution of water. Each Patkari can look after about 1,000 acres of land. There will be a canal Inspector for 4 to 5 Patkaries who in turn works under a Section Officer, and above the level of the Section Officer an Assistant Engineer will normally supervise the work and can manage 40 to 50 thousand acres. With all this system of supervisory staff, for the proper distribution of water particularly once in a specified period of time, experience has shown that the distribution of water has not been found satisfactory Generally the cultivator is too anxious to take water to his lands, no matter what happens to his neighbour. Some times, he will try to take water out of turn. This probably happens on account of the feeling created in the minds of cultivators that water would not reach their lands even when their turn comes. In order to obviate such misgivings, one can think of supplying rotation cards to the cultivators wherein they are informed of the dates on which water is expected to reach their lands. Normally the signature of the cultivators could also be taken for having received the water. Some such system would create confidence in the cultivator that if water is not made available to him, he could approach appropriate authorities. This has been tried in some places and, in general, it has proved successful and also the irrigators have come to appreciate the same.

However, certain inherent difficulties in the implementation and successful water management are normally observed. Distributories and field channels are at times meddled and damaged by mischievous cultivators and as a result, the law abiding cultivators are denied water supply on account of damage done to the water carrier system. In order to tackle these problems with some degree of success, water Panchayat Committees could be formed at the outlet and distributary levels. The Committee could consist of leading irrigators under the outlet or the distributries and in addition, the Committee could include an Agricultural Officer and an Engineering Officer. The main functions of this Committee would be to review periodically, certain difficulties experienced in the management of irrigation water. The normal complaint that is lodged by the cultivators, is in regard to the short supply of water and uncertainty of getting any water at all. As already pointed out earlier, this happens mostly due to the cultivators in the higher reaches making use of a greater share of water than is due to them. The Committee could easily trace out the culprit and could be brought round by local influence and an amicable settlement could always be arrived at. The normal duties that could be assigned to the Committee can be broadly classified as under :—

1) Implementing the irrigation programme drawn up for the Distributaries.

2) Solving minor disputes amongst themselves.

3) Prevention of unauthorised and wasteful methods of irrigation.

4) Educating the cultivators regarding rules and regulation of irrigation management.

5) Miscellaneous subjects such as increasing the efficiency of irrigation, use of improved seeds and artificial manures etc,

Although the formation of these Committees is a right step in the direction of proper

distribution of water, the Irrigation Officer is very often confronted with problems over which he appears to have no control. This is in regard to the commission of Irrigation offences. These offences have always been a contributary cause to the improper management of the irrigation water. It is therefore necessary that Irrigation Officer must have full powers to punish the persons committing these offences. The present practice of referring such offences to a Court of Law is, often time-consuming and requirements of law needs such an elaborate body of evidence that it is just not possible to produce all that in the Court of Law. It is therefore necessary and desirable that the Irrigation Officer is invested with sufficient powers to impose deterrent punishments to the erring cultivators.

Economic Utilisation of Water

Irrigation managements would have no meaning, if water is not utilised efficiently and economically. The flow irrigation that is now practised in many places is wasteful in nature. There is a tendency on the part of cultivators to take more water than is needed, since the cultivator is under the impression that application of more water would result in greater production. Therefore the over-use of water appears to be the bane of the present day irrigation practices. Another important factor contributing to wasteful methods of irrigation is that the lands are not levelled and also the excess use of water flows back into the valley. The water that is flowing in the valley could be picked up and fed back to the lands lower down by the construction of a number of pick up weirs. The construction of pick-up weirs in the command area must be made a part and parcel of the irrigation development programme. Therefore an integrated system of pick-ups carefully planned and constructed under the command will ultimately result in greater economic use of water.

Another source of wastage of water has been that the cultivators are not used to take water in the night. The irrigation water is normally allowed to go to waste in the night in some areas. It therefore appears desirable to dig a number of shallow wells in the command areas so that the water that cannot be used in the night could be allowed to be filled up in the well and the same could be pumped back and used on the land whenever required. Incidently such wells would also collect water from percolation, thereby problems of water logging are to some extent avoided. As a matter of fact a flow-cum-lift irrigation system often results in very high economical utilisation of water. The cultivator could be encouraged to dig such wells so that there is economic use of water. There is another very important purpose for which wells could be put to use. The cropping pattern in most Projects provide for a certain percentage of perennial irrigation. This could be dispensed with and water supply limited to 8 months only. Due to the general practice of irrigation all over the command the water table in the area generally rises and as a result even during the non-supply period of the irrigation water i.e. during the summer months, water which collects in the wells could be used for irrigating sugarcane in the non-supply period. This restriction of water supply to 8 months only, will place the Engineer at an advantage in repairing the canals during the off-season and also the water stored in the storage reservoirs saved and the same could be utilised in augmenting the total command.

There are other improved methods of irrigation whereby the economic utilisation of water can be increased to a considerable degree. The sprinkler system of irrigation is very popularly resorted to now-a-days but their application is limited to small areas. There is also the drip system of irrigation whereby water is taken in small tubes and allowed to drip into the root zone very slowly, so that the plant can utilise the water efficiently and economically. All water that goes below the root zone is not useful to the plant and can only be recovered as seepage water or under ground water. But these systems, of course, involve additional initial investments.

Another important point in the economical utilisation of water would be to prevent seepage and percolation losses.

Seepage and Percolation Losses

The usual method of doing so would be to line the main canal and distributaries. Some of the important advantages of lining are :—

1) The carrying capacity of the canal is increased due to the decrease in the coefficient of rugosity. Smaller section of the lined canal results in economical cross drainage works.

2) Water saved in percolation could be utilised for increasing the command under canal.

3) It prevents weed growth and erosion of soils. Lining of canal is of course a costly job and therefore it is desirable to take this work in stages. But the lining of the main canal and distributaries is to be considered as a "mus." in the planning of any Irrigation Project.

Land Development

The problems of land development from an important and integral part of water management. It is seem from experience that in some projects, reservoirs are completed and the distribution system is not completed, and vice versa. In some cases even when the reservoir and distribution systems are completed, there is no development under the command. Potential created is not fully developed, meaning thereby, that the cultivator is unable to make use of water, available for irrigation. There are several contributary causes towards such a state of affairs. The cultivator is probably unaware of the methods of application of irrigation water. There have been efforts on the part of Government to bring home to the cultivator the importance of utilising the irrigation water and the prosperity that will accrue to him by such utilisation of irrigation water through the media of Community Development Blocks and National Extension Schemes. Also the Agricultural Department is putting up Demonstration Farms and improved methods of cultivation such as Border strip methods of cultivation etc., in addition to supplying improved and high yielding varieties of seeds to the farmer. Another important reason for slow development of the command is due to the undulated nature of the irrigable land. Unless the irrigable land is levelled, the application of water becomes difficult and wasteful. Levelling of extensive areas of land is a very costly proposition and requires large investments of money. Of late, some institutions have come up in some areas of a co-operative nature where machinery is purchased and owned by co-operative units and hired out to the cultivators for their use. Also the Agriculture Refinance Corporation has been going round the Projects

to advance money to certain Land Development Banks, which in turn would give it as loans to small cultivators on the security of their lands. All this involves lot of procedural formalities and takes a long time before benefits are realised.

Another reason for non-development of land is due to large areas of lands being owned by single individuals. He is not in a position to cultivate the entire holding nor there is any initiative on his part to make efforts to bring the entire holding under cultivation. The land ceiling that is coming into force now, may have some effective re-action on the problem. But the ceiling if strictly enforced, will result in fragmentation of land into small uneconomical units. Therefore, there appears to exist contradictory conditions arising out of such situations. However some authorities have suggested co-operative farming as a solution in such situations. Here again there are administrative difficulties and results are not very encouraging.

Water Logging and Drainage

In order to increase the efficiency of irrigation water, water logging of certain vulnerable areas must be avoided by creating suitable drainage. Water logging may be due to the seepage of water from the canal sides or it might be due to over irrigating the lands. It may also be due to the soil itself being fine grained. The lining of the canals will, to a considerable extent, prevent the seepage losses. In areas where slope of the country is very small provision of under ground drains etc., will to some extent remedy the situation. A detailed discussions of various methods will be out of place in the present context. It is therefore sufficient to mention again the problems of water logging and drainage form an integral part of water management system.

Training and Research

In any organisation where efficient performance is required, it is necessary, that there must be scope for training and research. Training must be imparted to the field staff in respect of water distribution and also certain fundamental ideas regarding land development, cropping patterns, use of fertilisers and other related subjects, could be tought to the field staff, engaged on water distribution. Similar training could also be given to the cultivators themselves in the proper appreciation of intelligent use of water. In addition, research centres could be established in the command area. These institutions could devote their time in finding out the optimum application of water to the soils prevalent in the area, development of hybrid varieties of crops suitable to the locality and such other matters of interest relating to the development of the command. It is therefore seen that agricultural research forms an important part of water management system.

It is seen from the foregoing, that the management of irrigation water under the command of any project is not a simple affair. It needs a complicated organisation involving the expert services and knowledge of various technical men to be coordinated for the ultimate purpose of utilising the irrigation water to its maximum efficiency. In order to evolve a very efficient and economical water management organisation a few ideas may be suggested here. With the existing system of irrigation, the entire water conveyance system is constructed at Government cost and the responsibility of supplying water to the lands at all points of the command lies with the Engineering Department. This is a task of very high responsibility and some times the system fails as the task is too tremendous and depends

on the performance of a large body of individuals involved in the game. It sometimes appears desirable that the responsibility of management of irrigation beyond the outlet or the distributary point be transferred to a private organisation. They will in turn have their own organisation to manage the water distribution beyond this point. Water could be supplied to the organisation at a specified point and at specified rates for specified qualities. They will in turn collect water rates from the cultivators. The management could also be entrusted to a local co-operative society or a public limited company comprising of members, who are themselves cultivators under the command in question. This appears to be good proposition as long as they are well organised and managed, but they are not ultimately, free from the fear of exploitation if the organisation falls into the hands of a capitalist. Perhaps with the partial control resting with the Government, the organisation may be useful. However due to certain inherent difficulties mentioned above, the creation of autonomous water management Boards for each project appears to be a good approach to the problems. The board headed by a technical chairman has under it, officers of the Engineering, Agricultural and Revenue Departments. The Engineering staff will construct and maintain the water conveyance systems. All improvements required for water conveyance system could be undertaken with advantage without reference to an outside agency. The Engineering staff will also undertake measures for reclamation of waterlogged and salt-affected areas. The research units attached to the Engineering wing of the organisation, will undertake research problem peculiar to the locality.

The Agricultural Officer has the necessary Agricultural staff under him to supply manures, improved variety of seeds and agricultural implements. In addition, he will advise the cultivator in the improved methods of farming, optimum application of irrigation water and such other connected problems.

The Revenue Officer will be primarily responsible for the collection of water rates and Betterment Levy, on the demands raised by the Engineering staff. In addition, a judicial officer could be attached to the organisation for dealing with the cases of irrigation offences.

In addition to the above mentioned wings under the Board, it is necessary to have an accounts unit, whose responsibility will be collection of water rates, advancing of land development loans etc. Further a Public Relations Officer attached to the organisation would go a long way in making the organisation complete in itself. His duties would be to assist the cultivator and direct him to the proper authority whenever he is faced with a problem.

An integrated system of the type contemplated here, is sure to work with efficiency as the entire water management system, including distribution of water, land development, economic use of water, training and research as well as collection of water rates and enforcement of penal provisions for irrigation offences etc., rests with a single administrative authority. In essence, it is necessary that the various officers responsible for efficient water management must be made answerable to a single authority for the over all management. A detached system, where different agencies are at work for the due performance of the duties of water distribution, land development and collection of water rates, it is sure

to suffer for inefficiency as each of agency works without reference to one another, while the duties are mutually interlinked with each other. Therefore the creation of autonomous water management boards for big irrigation projects, appears to offer the final solution for successful management of water. The several associated functions involved in the problem can be performed with efficiency and economy.

MINING & OIL ENGINEERING

Mineral Wealth Beneath the Seas - Exploitation

By

M. BARANWAL, M. Sc., M. I. S. E. & SHAMIK,
B. E. (Non-Member)

India is now on the verge of exploiting the mineral wealth beneath the sea - starting with hydrocarbons it is possible in near future to concentrate on other minerals. At present the world production of sea floor minerals is estimated to be worth about 1,715 million rupees annually.

Minerals which are exploited at present from sea on commercial scale are (i) hydrocarbons (ii) sand and gravel (iii) calcium carbonate (iv) diamonds (v) sulphur (vi) barytes, tin and iron sands. Manganese, copper, cobalt and nickel.

(i) *Hydrocarbons*—Hydrocarbons tops the list as 17 per cent of present total oil production of world and 6 percent of the total world's natural gas production comes from off-shore sources.

For recovering hydrocarbons from off shore sources wells are drilled up which usually involves hole depths of 3,000 to 5,000 mts. These wells can either be drilled from a ship or from a fixed jack up, or flooting platform. For maintaining the well the same ship or platform is used or expert divers services are employed. The cost of employing fixed platforms rises steadily as the depth increases. One platform is generally used to drill up to 20 oblique wells and the production control valves are installed on the platform thus tapping an area of an oil field. The oil from such different platforms is gathered by and is transferred to the shore. If the depth of water increases by more than 40 mts, then the control valves are not set up on platform as it is then more economic to install the production valves and gathering lines totally on the sea floor. Six competitive systems are under development for doing this. Three systems out of these use the single well completion technic where as others use multi-well drilling and completion units. The former appears to be more economic and such system will be in operation very soon where water depth ranges 100-200 mts. These systems will not be needing an expert diver's services for maintenance. Single well sub-sea completions have the further advantage over multiwell system that the cost of installation

increases stepwise as the wells come on live. Whereas in the other method, the major capital cost comes before the first well is in production but operation and maintenance cost seems to be less in the platforms. The cost of installation for a platform in 70 mts. deep water is approximately 30 million rupees.

(ii) *Sand and Gravel*—It is the most important mineral commodity as far as tonnage mined is concerned and is second only to offshore petroleum in value of output. About ninety percent of it is used in construction industry and the rest for making glass, abrasives, ballast etc.

Sand and gravel is recovered by grab — bucket dredging operations. Less common in use are hydraulic and bucket line dredge

Dredge—Is an apperatus used for excavating under water and a dredger is a vessel specially equipped for dredging.

There are four methods of dredging the minerals, the first three used for off shore beaches and placer deposits upto 15o. mts. depth, whereas fourth can be used upto 300 mts. depth.

Method used	Practical economic working depth possible.
(1) Ladder bucket dredge	50 mts.
(2) Surface pump hydraulic dredge	60 mts.
(3) Wire line dredge	150 mts.
(4) Air lift hydraulic dredge	300 mts.

Process (1) consists of an endless chain to which buckets are attached. The chain moves buckets continuously which digs and are filled and brought to surface where they are emptied.

In process (2) a pump is used to bring the cuttings on shore.

Process (1) & (2) can be used only where the current is less and the deposit is not very compact. It is first cut and then lifted. Process (2) is useful where dredged material is to be collected at a very short distance from the dredging site.

In method (3) digging is done and the buckets are loaded and lifted to the surface by wire line. This method is used off shore effectively.

In method (4) air is compressed and injected into a pipe of 2/3rd of the depth of submergence. This compressed air causes the decrease in density of fluid column and the fluid column rises in pipe and overflows if the end of pipe is not too above the water surface. Water with surrounding material rushes up in pipe to replace lost liquid and the process continues. Flexible pipes can be used in this method causing many advantages.

The sand mineral so dredged contains iron upto 56% and titanium oxide 12%. In a number of locations sands of shells of animals are mined for producting port land cement. The sand contains mixture of shell particles and basallic tuff. Calcium carbonate upto 80% can be recovered out of this sand. The maximum depth of deposition is nearly 40 mts. These types of sands are recovered by hydraulic suction dredge. The suction head is kept on ocean floor which sucks up water and solid sand. The recoverable sand is upto 5%.

For exploiting sand and gravel deposite on emerged beaches open pit methods or any practical method of picking materials up off the ground is used.

(iii) *Calcium carbonate*—It is recovered by dredging in the form of calcareous muds, coral sand, coral or shells.

Calcium carbonate is predominantly found in calcareous oozes, in the form of the skeletal remains of various plankton animals and plants. Oozes are the sediments found in deep water and contains about 30% of organic remains. When the percentage is less than 30, it is called red clay. Silicious oozes consists largely of skeletal material produced by planktonic plants and animals. Western part of the Indian ocean has calcareous oozes and eastern red clays. Calcareous oozes can be mined by dredging and can be used to manufacture portland cement without crushing it.

(iv) *Diamonds*—Diamondiferous gravels can be dredged by Air lift hydraulic dredge method. The material so dredged is concentrated and treated with caustic soda and fish oil and then passed on a grease belt where diamonds stick to the grease belt and other minerals do not. Diamonds are also found in a mixed alluvium of sand gravel and boulders in shallow water depth upto 30 mts. and are recovered by other methods of dredging.

(v) *Sulphur*—Salt domes containing sulphur can be located by gravity surveys as the salt has very low density compared to surrounding rocks. To recover sulphur from these domes the water is heated to a temperature of about 160° and pumped under pressure to melt the sulphur deposit. The molten sulphur is forced up in a pipe surrounded by incoming water. The other method of extraction is beaching with chemicals or bacteria. The process consists of exacting the mineral through bore holes after dissolving or melting the deposits or after using chemicals or bacteria to leach them from the present rocks. The main difficulty lies in fracturing the ore body as large masses of permeable rock are required for satisfactory leaching. At present the only method in practical use is hydrofracturing of petroleum reservoirs and sulphur deposit in salt domes.

(vi) *Barytes, tin & iron sands, manganese, copper, cobalt and nickel*—Tin, barytes, and iron sands are recovered by dredging operations. Manganese, copper, cobalt and nickel are recovered from the deep sea floor in the form of manganese nodules. Nodules are formed by segregation about centres and are spheroidal, avoid or irregular in structures. Percentage of major constituents of manganses nodules is (by weight).

Mn °5	63.2—11.4 %
Fe 2°3	42.0—6.5 %
Si °2	29.1—6 0 %
Al 2°3	14.2—0.6 %

The composition depends upon the recovery place. The percentage of copper is 1.0-1.6, nickel 1.0-1.8, and cobalt 0.3-1.5. Nodules from the Pacific Oceans are betrer than nodules from Atlantic. Nodules populations range from two to seven ponds per square foot and extends in all directions up to hundreds of miles.

The prohibitive factor is the ratio of the various minerals in the deposits which does not coincide with world demand so that there would be no real market for some of the constituents.

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NOTICE

the next ORDINARY GENERAL MEETING of the India Society of Engineers will be held on Saturday the 26th August 1972 at 3 P.M., in the Office of the Society at 12-B, Netaji Subhas Road, Calcutta, to transact the following business :

1. To confirm the Minutes of the Proceedings of the last Ordinary General Meeting held on August 7, 1971.

2. To receive the General Secretary's Report on the working of the Society.

3. To adopt the Audited Statement of Accounts and Balance Sheet for 1971 with Auditors' Report.

4. To elect new members to and constitute the new Executive Committee.

5. To transact such other business as may be placed on the Agenda of the meeting by the Executive Committee or by members with the approval of the President of the meeting.

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SCIENCE & ENGINEERING

JOURNAL OF INDIA SOCIETY OF ENGINEERS

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SCIENCE & ENGINEERING

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Popular contributions on scientific, technological, engineering industries and other allied subjects are invited for publication.

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FIFTH PLAN OUTLOOK.

The New year for 1973 opens with an accent on hope. The past year 1972 was a year of turbulence, hopes for some, misfired hopes for others. The political horizon has however cleared, and the country has settled down to an expected period of political stability with high hopes for an unruffled period of industrial development.

The Fourth Plan for India passed through many vicissitudes. It started limping on its way after 2 years of uncertain annual planning period. The fourth plan inspite of its massive investments ranging round Rs. 21000 crores never actually gained its stature. Some of the objectives were partially fulfilled, others flopped. The last year saw again a downward sagging for agricultural performance, mainly due to vagaries of weather. Supposedly we had achieved a Green Revolution. In reality, however, the country was still dependent for its agricultural production on a good monsoon. The drought condition affecting Maharastra and the Western regions are, a pointer that if green revolution is to be a reality, then our power and irrigation problems have to be tackled on a war footing and agriculture has to be largely independent of whims and favours of monsoon. The irrigation system needs to be overhauled. A new outlook for watering the agricultural fields has to be developed.

In this background the country is now stepping into the fifth plan period shortly. The draft of the fifth plan is being made ready. The total investment is intended to be stepped up to about Rs. 51000 crores, nearly 5 times the investment of the Third Plan. Where from the resources for such a massive investment will come is a problem that is worrying the authorities and the Planning Commission. It has been proposed to step up production with fuller utilisation of newer capacities, and speed up exports on a massive scale. The foreign exchange problem has always been a headache. It will be so more than ever before. However, a way to meet this acute problem is to turn to a policy of increased self sufficiency and diminished need and extent for imports.

We thus come to the basic problem of increasing our production in the factories and fields to a high pitch, setting up in unending stream new factories, and giving a sweeping boost to medium and small scale industries. This needs spreading to a vast sector of new entrepreneurs finance and latest technologies on a scale that has to be incomparably larger than ever before.

The financing institutions' role is now not simply to advance money and give financial help. Their role is largely that of a monitor, that includes from resource survey of backward

areas, identification of industries best suited to regions and local people, to securing of managerial and technical skill, to business management technique on sound lines. Business managements of banks have to extend their activities to management of new equity issues of new companies, to depend more on personal guarantees and accept calculated risks than to proceed on the age old cautious method of financing and credit advancing. In fact, accent should be more on technology management for the technical and financial management for the banks and financing agencies in any new enterprise. The Fifth Plan for its success puts a further burden on the financing agencies to attract new entrepreneurs, medium and small, and develop their skill in business management.

While for a new enterprise technology is definitely for the technical, financing agencies also will be required to assure themselves that the technology offered is of the latest, that will make the project viable and capable of withstanding competitive market for a reasonable time, also capable of adaptation and improvement.

The Fifth Plan will require technology which should be third-generation technology, and not merely cast-off technology, of foreign shores. The need for India will be more for buying third-generation technology where and when needed, and adapting the design and technology and process know-how to Indian conditions, and increasing the research turn over to give a turn to the technology so developed to a sucessful forth-generation stage.

Research and Development should therefore be a key note to development of such technology, and a 1% levy on large industries is not on this account therefore too heavy. A comparison of turn over of Indian technical journals and foreign counter parts shows that India is still far behind in the march and it will take for her yet some more years and more intensive work in R & D to come to level with the standard and output of foreign technical journals

Nevertheless, the key note to Indian technical journalistic approach should be that the product of the R & D and the journalistic technical output should be more well geared to the requirements of Indian industry and the country's needs for industrial development than to any technical toying with technology that stands unrelated to the demands of the plan programmes. Only thus can the Fifth Plan meet with success.

THE ROLE OF HYDROLOGY IN PLANNING THE DEVELOPMENT OF A COUNTRY

by

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and

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Introduction

Of all the resources of a country, the most precious is water, being essential to all forms of life. Man has sought for existence in all extremes of climate. In equable climes communities have in general flourished but in more severe climates deterioration of vegetation and soil has led to devastating floods and silt-polluted water supplies and man has often been forced to abandon his attempts at settlement and seek new abodes in less harsh environment. Migration to greener valleys cannot continue indefinitely. In many regions population pressures are becoming acute while the underpopulated areas that in the past afforded alleviation are fast shrinking.

In this technological age the living standards of communities are reflected in the per capita water consumption figures In most parts of the world it has become imperative that soil and water resources be carefully husbanded and uses planned in such a way as to reconcile the growing and varied demands. In this planning the role of hydrology is all-important.

Hydrology

Hydrology is an earth science concerned with the distribution of water quantities and water qualities in time and space, it mainly investigates water in liquid gaseous and soilid states over continental land areas.

Hydrologic Cycle

The chain of events describing the history of water is called the hydrologic cycle. The cycle involves the total earth system ; atmosphere, hydrosphere, and lithosphere. The atmosphere is the gaseous envelope above the hydrosphere, the hydrosphere consists of the bodies of water that cover the surface of the earth, and the lithosphere is the solid rock environment below the hydrosphere. The cycle of activities of water extend through these three parts of the earth system from an average depth of at least a half mile in the lithosphere to a height of about 10 miles in the atmosphere.

In the hydrologic cycle, water evaporates from the oceans and the land, and becomes a part of the atmosphere. The evaporated moisture is lifted and carried in the atmosphere until it precipitates to the earth, either on land

or in the oceans. The precipitated water may be intercepted or transpired by plants, may run over the ground surface and into streams to oceans, or may infiltrate into the ground. Much of the intercepted and transpired water and some of the surface runoff return to the air through evaporation and transpiration. The infiltrated water may percolate downward to be temporarily stored as ground-water which later flows out of rocks as springs, or seeps into streams as runoff to oceans, or evaporates into the atmosphere to complete the cycle. Thus the hydrologic cycle undergoes various complicated processes of evaporation, precipitation, interception, transpiration, infiltration, percolation, storage and runoff. Figure illustrates the hydrologic cycle.

The cycle has its important influence in agriculture, forestry, geography, watershed management, political science (water law and policy) economics (hydroeconomics) and sociology ; and it has practical applications in structural design, water supply, waste-water disposal and treatment, irrigation, drainage hydropower, flood control navigation, erosion and sediment control, salinity control, pollution abatement, recreational use of water, fish and wild-life reservation, insect control and coastal works.

Although the hydrologist is interested in all phases of the hydrological cycle perhaps his main concern is with water during its sojourn on the land ; it is by control and utilization of water during this phases that civilized life on earth is possible. It is the hydrologist's task to assemble and interpret the data needed for rational planning of the control and use of water.

Necessity For Hydrological Surveys

Despite most careful planning in all other respects, development of a region without due regard to hydrological factors can lead to reduced productivity of the land, financial loss and indeed loss of life and damage to property Many costly projects have failed completely because of inadequate hydrological information at the design stage while others have been rescued only after heavy additional expenditure on remedial measures. Perennially dry and silted-up reservoir basins, water-logged or brack irrigation areas, these are evidence of insufficient attention having been given to hydrological investigation as a prerequisite to development. Although it is often difficult, especially in a new country, to provide against all possible conditions of flood the annual toll of flood damage to roads, railways, bridges and other works would be considerably reduced if location and design of these structure were based on reliable and adequate hydrological data.

In planning the development of a region it is necessary to appraise the water resources, to estimate the demands and to predict the effect of each type of development upon the water balance within the region and upon the quantity and quality of water that will pass on to downstream consumers. Often adverse effects become evident only when the cost of rectifying matters has become prohibitive.

It is seldom that those responsible for actual design and construction are to blame for failure of a water scheme. Frequently as the result of public clamour and group pressure, projects are embarked upon against the advice of experienced engineers. Over-optimistic proposals could readily be kept within reasonable bounds

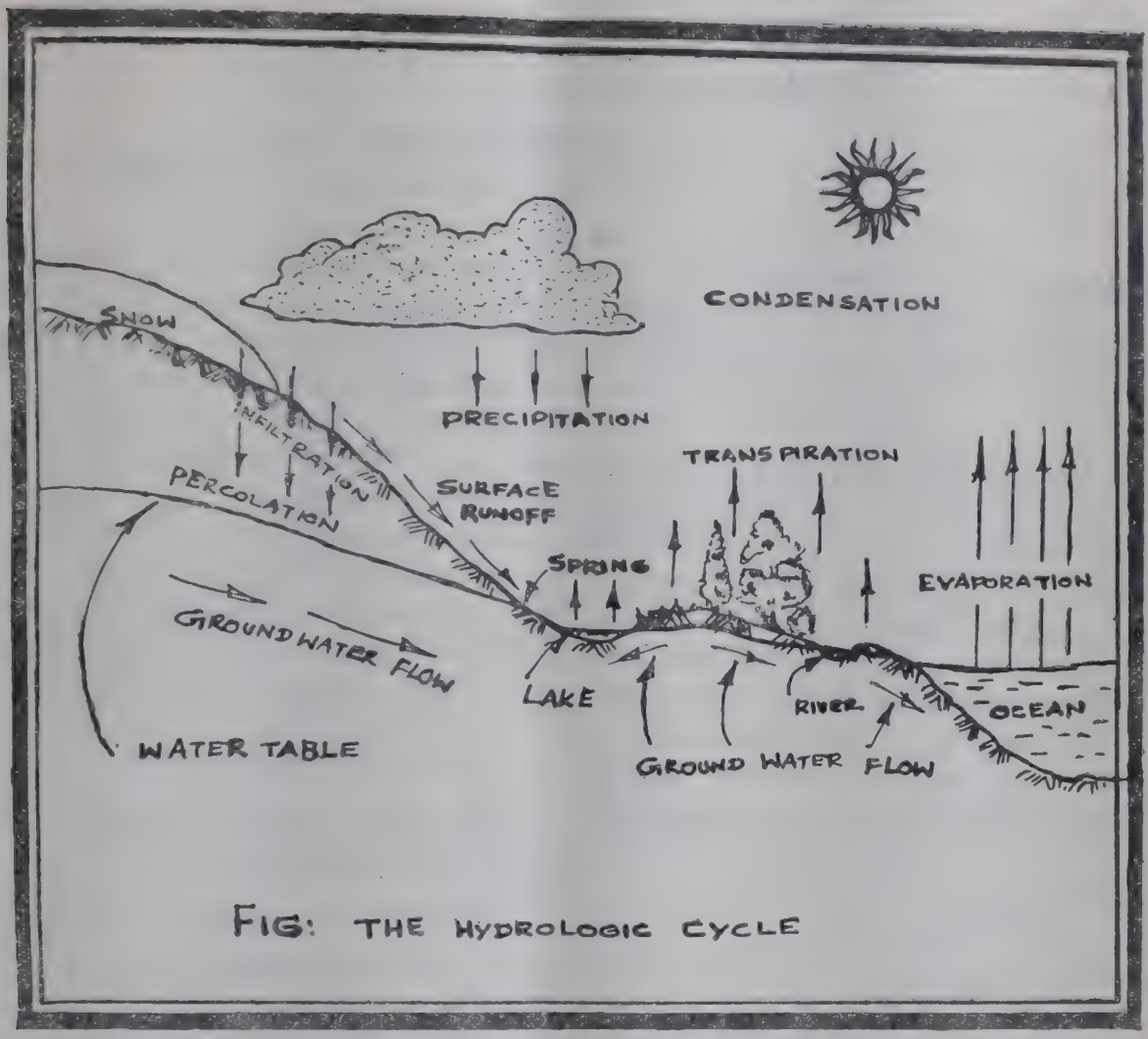

FIG: THE HYDROLOGIC CYCLE

if all the hydrological facts and consequences could be clearly set out and the permissible limits of development authoritatively defined.

Conclusion

There is ample evidence in history, ancient and modern to prove that the activities of man have caused deterioration of the land and its hydrological characteristics. Just as evident is the fact that by conservation practices and careful management these qualities can be improved. Through critical study of cause and effect the hydrologist can play an important role in raising living standards and making his country self supporting and prosperous.

TRANSMISSION LINE TOWERS

by—Harbhajan Singh, B.Sc., A.M.I.S.E.,
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Transmission Line Towers (T. L. T.) are the only means of conveying Power throught the length and breadth of a Nation.

Design

The structural design of T. L. T. is not an exact science, because without the development of Lines (i.e.66KV or 132KV or 400KV Single circuit or Double circuit) the designer can not ascertain the exact magnitude, combination or frequency of loads required for the lines and the strategic and economical risk, and availability of the materials. Thus before designing the T. L. T. the development of the lines is and must. The basic assumptions of designing are :

1. Foundation

The foundation of broad based tower should be perfectly rigid and should strengthens in the whole steel structure in it. The foundations are designed to have a S. F. (safety Factor) of—2·½ on the normal working load and 1·1/2 under broken wire conditions. The distribution of Stresses in Intermediate towers is such that one pair of legs is in Tension while opposite pair of Legs in compression i.e. the tension legs tend to uplift the adjoining earth of the foundation while the compression legs tend to push the earth down. But this pattern of distribution of forces is reversable due to **windload** or breaking of wire. In the case of **Terminal Towers** one pair of Legs always remain in tension, another in compression and the wind load adds or substracts to these effects depending upon its magnitude and direction. Usually foundation **Depth** is 10ft. to 12 ft but in places where exacavation is difficult due to Water level if high, the depth should be 6 to 7 ft. and the base of the tower should be broadened. Foundations on piles in sinking soils, concrete raft in low bearing soil or water logged, areas, are some times necessary

2. Steel Structure

The structure of T. L. T. depends upon :

(a) Electrical Clearances.

(b) Mechanical Strength.

(A) **Electrical Clearances :**

Tower **heights** depend upon (I) Ground Clearances of the **Conductor** required by the Over Head Line regulations (II) Vertical spacing between conductors and their sag.

Conductor spacing depends upon the economic considerations and is based on the **Dynamic Voltage** conditions with some allowance for reasonable performance against **Lightening surges**. Air clearance must be large enough to have as great an impulse break down as that over the insulator itself. On suspension position of insulators the swing of conductors depends upon the ratio of transeverse force to the dead load acting at

that point. Usually 45 degree is taken as **Angle of Swing.** The clearance between the live parts and tower members can be determined by : Clearance 0.31/K. V. ft.

(B) **Mechanical Strength** : The loads to be carried by T. L. Ts. on straight runs are : (i) Windage on Tower (ii) Windage on conductors (iii) Vertical load due weight of the supports (iv) Insulators (v) Fittings.

Thus the mechanical design strength should be such that under adverse conditions of wind, or under conditions of conductor tension or line deviation the structure should take the full load without any deformation. The towers on **Angle Position** in addition to above loads have to bear permanent longitudinal pull, in the direction of the line. The **Dead End Towers** are also subjected to such loads except that the longitudinal force in the direction of line is undirectional and the one set of tower legs are in permanent compression while the other in Tension.

3. Wind Pressure on towers

$P\ KV^2$ where Pis pressure in lb. per sq. ft. Vis velocity of wind in miles/hour Kis Constant 0.0031.

It is assumed that wind pressure of 20 lb. per sq. ft. can develop on a steel work when the wind vilocity is 80 miles per hour. The force on the wind wardside of tower is taken as 20 lb. per sq. ft. and on the Leeward side half of this.

4. Wind Pressure on conductors

Assuming the wind force as 20 lb. per sq. ft. and considering cylindrical surfaces of the conductors exposed to the wind, the wind pressure is taken as 2/3 of 20 lb. per sq ft.

5. Vertical Load on Tower

The vertical loads acting on a tower structure are the weight of the tower, Insulators, Fittings and load of the conductors.

6. Working Stresses on Tower

In keeping with Hook's Law the working Stresses in T. L. Ts are very carefully choosen so that the working forces should be within perfect Elastic limit. The working Stresses are :

(a) Tensile Stress : 16000 lb. per sq. in. on net section (for drilled holes). If the holes are punched then an allowance in the working stresses should be given as punching destroys the tenacity of the annular ring of the metal surrounding the hole.

(b) Compressive Stress : 1600—59 L/R lb. per sq. in. for $L/R \angle 150$ 12250-44 L/R lb. sq. in. for $150 \angle L/R \angle 250$.

(c) Shear Stresses or Axial Stresses : 11200 lb. per sq. in. shank area of the bolt.

(d) Bearing Stresses : It is twice the Shear stress.

7. Safety Factor

2.5 under normal conditions.
1.5 under broken wire condition.

Hence the method employed in designing a tower structure is to calculate the dead load due to tower, insulator, fixtures and conductors, and transverse loads due to tension in conductor at angle or relative position due to elevation, longitudinal and torsional loads in broken wire conditions, the force due to wind assumed if that were momentarily static loads and then to equate the overturning moments caused by these loads in various combinations

and at various sections, with the internal resisting moment of the structure i. e. the restoring force. The stresses developed in various members of various type of structures under normal and broken wire conditions are calculate through load and stress diagrams or analytically and then the safe performance of every member of the structure whether in tension, compression or under complex stress is calculated. The working stresses are only allowed in various members and the eccentric bolted connections, which bring in the bending stresses at joints, are avoided. The conception of net area in tension members, slenderness ration in compression members and reversal of forces which cause members to act in tension and complex stresses is considered for arriving at safe working stresses. The fatigue effect on towers, which is conveyed on them due to vibration of the conductors, is also kept in view for it can loosen the bolts and can help in developing the progressive growth of any minute crack in the structure thus depriving it gradually of its inherent strength. Because of the protal action of the frame in distribution of stresses it needs a particular care in making selection of its bracings and in lacings. The structure really is made up of a continous series of small struts and ties of varying lengths placed end to end, and each of these small struts has both ends pinned because of the single bolt connecting it to the other member or two bolts connecting it to the gusset plate. Should one of the small struts buckle sideways the complete structure, of which it an element, would also collapse i. e., the strength of such struts must not be less than of the main leg members.

8. Type of Towers :

Generally T. L. Ts are designated as A type Towers, B, C, & D type. The weight of A type Towers is are 2.0 M/T to 2.5 M.T.

B „ „ „ 2.5 M.T. to 3.5 M.T.
C „ „ „ 3.5 M.T. to 4 5 M.T.
D „ „ „ 4.5 M.T. to 6.5 M.T.

River Xing Towers 16.0 M. T. to 42.0 M. T. (depending on the height and base of Tower reqd.)

Extensions for A & B type towers 0.8 M. T. to 1.2 M. T.

The weight of Template for A ? B ? & C type towers ; 0.6 M. T. to 1.2 M. T.

The template is a painted structure, not to be galvanised

9. Parts of a Transmission Line Tower :

A tower consists of the following portions :

A. Bottom Portion :

This consists of Stubs, stub-cleats Keying rods, etc. The stub is a member generally half galvanised and it goes 2/3rd. into the R. C. C. foundation. Cleats and keying rods fitted at the bottom end of the stub act as fasteners inside the foundation. The setting of stub inside the foundation is done by a Template, which is a rectangular bolted structure and this keeps the slope and squaring of the tower correct, The first Leg of the tower is fitted with top galvanised end of the stub and earth wire is connected with the earthing holes of the stub. This bottom part also contains Danger flats on which Danger Plates are fitted, and Bird Gates, Anti climbing Devices. Mostly heavy steel sections are used in this portion.

B Middle Portion :

This portion contains 2nd & 3rd. Leg members (or 4th also) and 3rd leg is a bend leg, and from this legs bend point, is fitted first X arm. The Xarm and its Tension member or Rafter are consist of hot and cold bend members and are provided with Angle Cleats, Strain Plates, Strain Cleats for fixing of Hangers. This portion is having heavy and Light sections.

C. Parallel Portion :

As in this portion the tower maintains almost a square shape i.e. Transverse and Longitudinal faces run parallel to each other and the lattices or bracings are fitted mostly with gusset plates. This portion contains 2nd and 3rd, X arms and is having light section.

D. Peak Portion :

This contains Peak member and Cap-plate, which are hot bend members. Here the steel sections are very light in comparison with other portions.

10. Towers and it Related Members :

1. Template : It is a rectangular type of light bolted painted structure having its Leg members at a particular Angular degree and is used for Stub-setting and erection of bottom portion of tower.

2. Extensions : As the name signifies it is a bolted light galvanised structure used for extending the height of the tower. In hilly plains or in low lands the height of the towers are to be raised to maintain the equal level of all the towers in the profile, and here extensions are fitted with the top galvanised end of the stubs.

3. Hangers : These are made out of M. S. Rounds and are hot bend, and used for hanging insulators and conductors.

4. Step Bolts : Transmission Line Towers are purely bolted structures. These step bolts are to be fitted with one of the Leg members throughout the tower usually at a spacing of $2 \times 1\frac{1}{2}$ ft. and this helps the Erection man to climb on to the tower.

5. Walk Ways : These are usually required for heavy towers and River Xing-Towers. These are made out of Chequred plates, flats, and rounds, welded and bolted at the Xams. These are helpful in erection of tower and fitting of tower accessories stringing of line etc.

6. Ladders : These are fabricated out of light angles and rounds welded together and are used for heavy and very high towers.

11. The percentage of Members in a A or B type tower :

a. Straight Leg members :	27.5%
b. Bracings (Light & Heavy)	50.0%
c. Plates & Cleats	2.5%
d. Bend members (hot and cold)	20.0%

12. Machinery and Equipment Required for Fabrication of T.L. Ts.

A.(1) Universal Iron Worker or Shearing-cum Punching-Notching Machines. (Pedding Capacity of the Machine : Reqd. 3 Nos. (haus German made) 210/11 Punching : 8mm. thickness 3/4" hole dia. (Stroke speed 10 holes/minute).

Angle Cropping :	Ls. $90 \times 90 \times 8$
Plate Shearing :	8mm. thk.
Bar Cutting :	3/4" M. S. Round
Notching :	Flat notcher or V shaved notcher for 8mm. thk. angles.

(2) Peddinghaus Machine Model 210/13. Reqd. 1 No. Capacity of the machine :

Angle cropping	:	Ls. 130×130×12.
Plate Shearing	:	12mm. M. S. plate
Bar Cutting	:	1½" dia. M. S. Round
Punching	:	12mm. thickness 1" dia hole. (10 hole./ minute)
Notching	:	Flat notcher for 10mm. thickness.

B. Radial Drilling Machine

capacity	:	2½" dia. hole capacity (in sub-station structures hole dias are usually very big)
Arm Length	:	Can move easily within a radius of 3½ ft.
Stands	:	Moveable Trolley capable of holding minimum 4 Pcs. of Leg members of heavy sections ie. 200×200×20

C. Bending Presses :

A. Heavy Ball Press of the capacity of exerting pressure of 60 M.T. for Hot Bending of Heavy Legs 150×150×15 and Karms. Reqd. 2 nos.

B. Small Ball Press of capacity 10 M. T. for the bending of Cold bend members or hot bend members of light steel sections. and for straightening of sheared gusset plates. Reqd. 2 Nos.

D. Equipment for Angle Straightening :

a. Roller type Straightening Machine for Ls. up to 90×90×6.

b. Jim Crow having 5" dia. screw for R.S.C. and R.S.G. and heavy sections.

c. Welded Angle stands for lighter sections.

E. Gas-cutting set :

One gas cutting set with appropriate nozzles for the gas cutting of heavy sections and for hill cutting of joint cleats if pneumatic chisel is not available for heel cutting.

F. Welding Set :

One generator Arc welding set of 15 H. P. for the welding of fixtures and jigs and sub-station members and Hangers, walkways, ladders stair cases etc.

G. A well-equipped Smithy Shop with two hearths and powerful Air Blowers.

H. A heavy duty Pedestal Grinder for the grinding of Gusset plates, tools and cleats etc.

12 I. One heavy duty Flexible shaft grinder grinding of heel and trims of Heavy Sections.

J. Figure and Letter punches Dies, Punches, slot-cutting dies, and various other small tools required in the process, and Cast iron or Fabricated-Bending Dies.

13. Fabrication Procedure :

The Fabrication of Transmission Line Towers is a Stream Line Process and all the operations are realated to each other. The most effective way of Fabrication can be adopted in the following sequences.

1. Cropping 2. Figure / Letter punching 3. Straightening 4. Punching (for members which do not require marking) 5. Marking 6 Bending and Marking of Bend members. 7. Punching of Bend members 8. Drilling. 9. Flange, notch or corner cutting 10. Grinding 11. Deburring and final finishing of the member 12. Process checking.

14. **Specification of Hole Dia :**

In America the standard dia. of holes in T. L. Ts is 23/32% as it is practically observed that during galvanazing a thick-layer in the form of a ring is development inside the hole of the angle, for 23/32" dia. holes 5/8" galvanised nut/bolts are to be used. But the latest practice is to use 11/16" dia. holes and 5/8" galvanised nut/bolts are to be used, i.e the dia. of the hole should be 1/16" larger than the bolt diameter.

15. **Clearances for Dies :**

The standard practice of clearances for piercing dies punches is that the dia. of the die should be more, by 12% of the thickness of the material to be punched. The die punch should be of High Chromium High Carbon Steel and properly heat treated in electrically heated furnace.

16. **Tollerances to be allowed in Fabrication :**

The general tollerances allowed in Fabrication of T. L. Ts are :

a. In a overall length of 4 M	1mm.
b Centre to centre distance in 2 M length.	0.5mm.
c. Straightness in 2.5 M	1mm.
d. Bending (at the flange)	0.5mm.

17. **Safety factor for Punched holes :**

The punched holes should be circular and not at all tapered, because if the hole is tapered, than this edge of taperedness will result in the shearing of hole during erection of the member in the Line. Before notching or corner cutting of the members which are to be fitted inside the tower it should be checked that the Lap of the cut is not less than 10.5 mm. from the edge of the hole or 20 mm. from the centre of the hole.

18. **Galvanising :**

The galvanising of T. L. Ts shall be done by Hot-Dip process in full compliance with the ISS 728-1956. Where Indian standard specifications are not available, the relevant British or American (A. S. T. M) standards shall be used. The thickness of Zn on the material should be 2 oz. per sq ft. of the material and the material should stand 4 Dip-test of Cuso 4 (Copper sulphate solution). The Zinc consumption of the material should be 5 to 6% of the weight of the material and the Zinc used should be 99.99% pure. Briefly, the Hot-dip process of Galvanising can be explained as follows.

a. Cleaning, de-rusting of Steel section : First of all the material to be galvanised should be cleaned de-rusted and treated in a hot solution of Caustic Soda for removing any paint, oil, grease or rust. The surface of the material should be scraped with steel wire brush.

b. Pickling in Hcl. acid. The clean material is dipped in an acid tank cotaining Hydrochloric acid of strength 45% and is allowed to pickle for a period of time depending on the thickness and the nature of the material. Here all the salts and rust dissolve inside the acid tank and gives a fine surface of bluish colour to the material.

c. Rinsing : The pickled material is dipped and washed in a water tank just to remove last trace of acid or any other salt from the material.

d. Fluxing : After proper rinsing the material is dipped into a tank of strong solution of Zinc ammonium chloride called as flux. This flux gives a primer coating for galvanising and then the material is allowed to dry on a dry furnace until and unless it is perfectly dried up.

e. Galvanising : Finally the dried material is dipped in a tank or Zinc bath at a temperature of 450 degree centigrade to 460 degree centigrade for a small period of time depending upon the thickness of the material. After galvanising the hot material is allowed to cool in a water tank. For shining surface of the material aluminium is added in the molten zinc. The best galvanised material should have a light ash colour and smooth and equal deposition of zinc all over the surface. The hot Dip galvanising process increases the life of the material minimum by 20 years

General views on Towers : Due to the high prices of Zinc and import difficulties at present days the towers are not fully galvanised. Only stubs (partly galvanised) Xarms, Rafters, Cap plates and Hangers are galvanised and the rest are to be painted with first of all with Zinc Chromate two coats and after erection with two coats of special Aluminium paint, and such towers are to be painted after every three to four years.

The Fabrication of Sub-station structures is also being followed in the same principles.

Society Notes

INVITATION TO WORLD CONGRESS OF ENGINEERS AND ARCHITECTS IN ISRAEL

The Association of Engineers and Architects in Israel, in co-operation with the International Technical Cooperation Centre, will convene the 3rd World Congress of Engineers and Architects in Israel from December 17 to 21, 1973.

Its main theme will be :

DIALOGUE IN DEVELOPMENT
NATURAL AND HUMAN RESOURCES

The background of the Congress and the sub-headings of its main theme are explained in the preliminary programme as below :

In extending their kind invitation to the India Society of Engineers to this Congress the sponsor Association Writes.

"We shall be very pleased if your organization will send an official delegate to the Congress, who will be our guest in Israel during the time of the Congress."

"Written Papers on the various subject outlined in the programme are welcome and will be submitted to the Editorial Board for pre-congress publication; they should arrive here not later than by the end of April 1973."

I S E. Members willing to participate in the Congress, but at their own cost for travel to and from Israel, are requested to write to the Hony. General Secretary of the Society as early as possible. Those intending to present papers for the Congress will do well to send typed out copies in triplicate to the I.S.E. Office sooner.

PROGRAMME FOR KEY LECTURES

Group : Development and Natural Resources.

1. Energy in Developing Countries :—
   Water—Electricity—Solar—Atomic.
2. Mineral Resources in Developing Countries :-
   Petroleum—Metals—Other non-metallic Minerals.
3. Water Resources and Water Supply :—
   Irrigation-Standards of Water Quality-Integration of desalinated water in Water Supply Systems-Water mixing Problems and Corrosion
4. Natural Resources and Developing Industries :—
   Agro-Industries-Industrial Labour-intensive industries Science-based industries.
5. Natural Resources and the Process of Development :—
   Planning-Institutional-Economic-Technological-Human.

Group : Development and Human Resources.

1. Rational Allocation of Man-Power Resources
   Methodology — Institutional — Constraints Labour Mobility - Incentives—Communications.
2. Education and Vocational Training :-
   Industrial Training—Agricultural Training-Availability of Educators—Emphasis on Education and Training-Para-Medical Training and Health Services.
3. Human Welfare and Productivity :-
   Implications of Technology-Cultural Patterns and Industrial Organization—Community and Social Services—Housing—Health and Nutrition.

Group : Man and Physical Environment.

1. Decision Processes in Development :-
   Methodology-Comprehensive Planning-Political and Professional Influences-Community Participation-Aspects of Centralization.
2. Regional and Urban Planning :-
   Mathematical Models and Optimization-Sectoral Goals and Regional Planning-Urban Design-Urban Infrastructure Development-Slum Clearance and Neighbourhood Unit Planning.
3. Housing :-
   Housing for Low-Income Families-Self-Help Housing-Construction in Hot Climates-New Technologies—Industrialization and Prefabrication
4. Environment Pollution :-
   Air-Water-Noise-Sewage and Garbage-Environmental Control.
5. Transportation :-
   Transportation and National Development-Land-Sea-Air-Mass Transportation.
6. Civil and Structural Engineering :-
   Materials and New Technologies-Industrialization-High Buildings- Equipment-Undergrounds, Viaducts and Bridges.

I. S. E. Programme of Activities—1972-73

The following Departments and Committees have been appointed with the respective members, to execute the different programs of activities as cited below, under general supervision of the President and General Secretary.

Development Department :
Advisers— Shri R. K. Banerjea
Shri S. Bhattacharji
Convenor— Shri S. K. Ghosh
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To all our Readers
Greetings of the Season
and
Goodwishes for the New Year 1973

SCIENCE & ENGINEERING

JOURNAL OF INDIA SOCIETY OF ENGINEERS

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SCIENCE & ENGINEERING

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NATIONAL DEVELOPMENT OPERATIONS

To aid in the reporting and controlling of development operations by various development teams some governments like Malayasia have evolved a technque which is unique in many ways. A 'national operations room' functions close to the Prime Minister or Deputy Prime Minister's Office, and similar if less elaborate 'operation rooms' function also at the state and lower levels of government. In all a hundered or more such rooms can be scattered over a country.

In these 'operation rooms' are put up maps and charts on sliding rollers showing for every department the exact location, and the details of each and every project under construction. Along with these are made available films, tape recordings, diagrams and progress reports. The various visual aids are kept upto date by the men actually responsible for the projects, so that actually the staff to maintain the rooms usually consists of one attendant, a young clerk or draftsman. The responsible officers are required to make personal reports here to the Deputy Prime Minister or to the Cabinet Ministers, or to the state or district officers in case of 'operation rooms' at lower levels. In course of such reports problems holding up work receive special attention.

In such 'operation rooms' programmes, each meeting of a development committee at whatever level is apt to be preceded by project briefings. Since department heads do not know in advance what questions they might be asked during their oral reports, they are under constant pressure to keep fully informed on all details of their projects. This happens to be advantageous to administration.

Ministers and other high officials in their travels about the country also can made a practice of visiting the local 'operation rooms' for briefing prior to visiting the projects on the ground. The accuracy of the reports made by the officers in charge of the projects can therefore be correctly checked, while at the same time their personal involvements and development planning is made clear for all to see.

Actually the idea of such civil 'operation rooms' developed from similar 'operation rooms' used on military side as centres for keeping track of the enemy operations and for planning strategy.

A form of progress report is devised to help keep track of individual projects, and show how actual performance is measuring upto planned targets.

For this purpose each project for which financial provision has been made, is divided into six distinct stages. These are obtaining the site (Stage A), drawing up specifications and acceptance of tenders (Stage B), through purchase of equipment (Stage C) dock clearance and transport of the equipments to site (Stage D), erection of the equipments and civil works (Stage E) and final completion and commissioning of the project and final completion (Stage F).

Target dates are set at the out set for the various stages, and the actual status of the project each month as its progresses, is charted.

The progress chart on which target dates and actual progress are recorded contains a horizontal row of monthly boxes opposite each project. Each box is divided into two triangles by a diagonal line. The target lines set for the various stages through which a project will pass, are indicated in the upper triangles of the row. Actual progress is recorded in the lower triangles.

Colours are used as easy indicators of progress. Thus where actual progress is upto schedule, the entry in the lower triangle is made in black. If a project has fallen behind schedule, red is used. If it is ahead of schedule, green is used. Thus a quick glance at any departments progress chart enables one to see how its projects are fairing. Where the red danger signals are flying, awkward questions are sure to be asked in the 'operation rooms'.

Accompanying the charts are kept monthly reports which permit easy recording of reports and easy explanations are 'pertinent and terse'. Such progress charts and monthly reports, apart from keeping a close check on constructional operations of a developmental project, can also be useful in budgeting and controlling project expenditure.

However, it is difficult to deal with certain training, research and experimental schemes in the above manner. Such projects are therefore omitted from the charting process.

The great virtue of this form of charting and reporting is its ability to bring to light promptly bottlenecks holding up progress. The 'operation rooms' thus in a sense focuses the race towards development as a race against time. As the Chinese proverb says, 'an inch of time cannot be bought with an inch of gold'. Wasted time is lost forever. The five years of a plan period actually amounts to one thousand full working days, what with week-ends, public and religious holidays, normal sickness and leave of workers, rainy days and flooding and the like.

The 'operation rooms' also contains a 'Red Book' with red cover (red here standing for rural economic development). Each district of the country has a district 'Red Book' measuring $2\frac{1}{2}' \times 3'$. It contains a basic map for the district mounted on the back cover and uses different colours to denote areas already developed, areas not suitable for agricultural development, and areas where new development is possible. Various inter-leaving

specialised maps are also contained in the books and show location in the district of projects in different fields, like land use, roads, water supply, and so on. The location of new projects and their relation to other projects can thus be easily made clear.

In this arrangement, proposals for new projects originate in the villages themselves or in government offices, and are shifted by the district development committee before being passed upto the state development committee for acceptance or rejection. Thus the 'Red Book' plan is intended to make it easier for ideas to flow upwards from the village to the state or national level and to planning commission, specially ideas regarding purely local improvement that can directly benefit villagers.

The important benefit for such system is that it helps to redress imbalances by supplying farmers and other rural dwellers with land, roads, water, electricity, schools, credit and so on. The red books ensures that among the benefits are those which the common people themselves desire, and indirectly it wins support for development planning, monetary saving and investing in national economy among the people.

Our country and our Government at Centre and State levels can study the system in detail, and where applicable utilise the system for national benefit.

PRODUCTION OF AROMATICS IN INDIA

By

U. P. MULLICK (M)

Synopsis

The world demand for aromatics is increasing even more rapidly than demand for oldfines. The Coal Coking industry is no longer a significant source of the aromatics to satisfy the market demand.

The demand for aromatics is increasing at a faster rate than that for olefines. Hence the importance of recovery of aromatics from Petro-chemical sources is fast rising. The Coking Coal industry is now no longer a significant sources of the aromatics to satisfy the market demand.

In India the Gujarat Aromatics Projects will utilise a special naptha fraction from the Gujarat Refinery to produce (a)21,000 tonnes per annum of Orthoxylene, (b) 17,000 tonnes per annum of Paraxylene to be converted into 24,000 tonnes per annum of Dimethyl terephthalate (DMT) and (c) 2,500

tonnes per annum of Mixed Xylenes. Para and Orthoxylenes will be sold to other processing units for manufacture of Phthalic Anhydride which is used in the manufacture of plasticisers, dyes, intermediates etc. Dimethyl terephthalate will be sold to polyester fibre manufacturing units. Mixed Xylene will be used as solvents for various applications. The quanity of Orthoxylene to be produced will just meet the total requirements of Phthalic anhydride plant capacity up to 1975. The value of the products on full capacity will be around Rs. 15 crores.

Considerable progress has been made in the implementation of the Aromatics Project. Civil construction of the plants is well on the way. Orders for almost all long delivery indigenous equipment have been placed. Erection of the plant and equipment will commence towards the end of this year and mechanical completion is scheduled for December 1971.

The world wide demand for aromatics is increasing even more rapidly than the Olefines. The coal coaking industry is no longer a significant source of the aromatics to satisfy the market demand.

Pyrolysis naptha from olefines production and the reformates constitute the major raw materials for the recovery of the aromatics. For commercial extraction of aromatics from non-aromatics, new types of solvents with excellent selectivity have been found. The most notables are Sulfolane and N-methylpyrrolidon. Production of specific isomers at a lower cost has been achieved by developing new types of isomerization catalysts and techniques for the separation of benzene, toluene, xylenes and ethylbenzene. However while benzene and toluene can be easily separated by distillation, this is not possible with the C^8 isomers. Ethylbenzene having the lowest boiling point is separated by superfractionation in towers upto 360 trays and a refluxer ratio on I : 120. Meta and Paraxylenes are separated by fractional crystallisation, taking advantage of their different freezing points of—48° and—13°C.

Benzene

Production of Benzene in India in 1967-70 was about 85,000 t/a. Recent estimates indicate that the requirement by 1973-74 will increased to 140,000 t/a. The main uses of benzene are in the production of polystyrenes, nylon, pesticides, detergents and phenol.

The installed capacity for the major products of benzene and projected demand for 73-74 are :

	Capacity installed 69/70 t/a	Projected demand 73/74 t/a
Pesticides BHC	18,000	52,000
DDT	4,200	15,000
Caprolactum	—	34,000

Xylenes

Production of Xylenes at present is negligible. The projected demand for P-Xylenes by 73/74 is expected to be 45,000 p/a. The major product is DMT for which the installed capacity is negligible, at present, and projected demand for 73/74 is 26,000 t/a. The proposed petrochemical plant at Koyali is expected to produce 20,000 t/a of caprolactum and 25,000 t/a of DMT.

For the purpose of production at Haldia complex a production of 50,000 t/a of benzene, 10,000 t/a O-xylene, 10,000 t/a of P-xylene and 5,000 t/a of DMT can be considered from the liquid fractions.

N.B.—Paper received by the India Society of Engineers on 17. 3. 1973—Ed.

GREEN REVOLUTION

By

T. SOMASUNDARAM, B.E. (Mech), A.M.I.S.E.

Production Manager, Modern Rice Mill,

Cheyyar Co-op. Marketing Society, Cheyyar, N.A.

Paddy Rice Utility

Pioneers of Modern Rice Mill who have, made a series of studies; demonstrated that there is a vast potential for improving the entire post—harvest handling and processing of rice with Modern Rice Mills.

This will drive (1) An improved out-turn ratio.

2) A superior quality of milled product.

3) Cleaner by products of greater value.

4) Reduction of wastage and storage losses.

5) Better economic return for producers and processors.

6) A valuable employment potential for professionals who may make Appallo improvements in Rice Technology and many others.

While there is a markable achievement in the field of Agriculture front with the "GREEN REVOLUTION" movement, it is an unfortunate fact to note the non-performance to make a significant and simaltaneous achievement to streamline, the post—harvest handling, processing of paddy grain to enjoy the above recounted estimables.

It has been laid down beyond doubt through a study sponsered by the Government of India to evaluate the over all performance of Modern Rice Milling and has been undertaken from 1956 for a couple of years by a team of experts consisting of :

1. Dr. H. S. R. Deshikachar, Chairman. Discipline of Rice Technology CFTRI, Mysore.

2. Dr. P. K. Kymal, Executive Director, Food and Nutrition Board.

3. Thiru S. T. Khushalani, Formerly Director, N.C.D.C. Delhi.

4. Thiru J. E. Wimberly
5. Dr. Derris D Brown } Ford Foundation.

6. and A representative of the Director of I.A R S. and Co-workers ; that there is an increase in the yield as a whole and head rice by the Modern Rice Mills as compared with the out-turn of the Sheller/Huller conventional mills :—

Vide :

Modern Rice Mills on raw paddy Deshelling give an over all increase in total rice out-turn averaging 2.5% over sheller type and 6.6% over huller type. Modern Rice Mills on Par Boiled Paddy deshelling gave an over all increase in total riice out-turn averaging 0.8% over sheller type and 1.6 over huller type.

Considering the high Nutritive and Protein Content of rice at 4% polish the CFTRI, Mysore, specified the Modern deshelling to be limited to 4% polish. At this polish even a 100% deshelling is not possible in Sheller/Huller conventional mills (the amount of paddy coming out with rice at this level of 4% polish varied from 5 to 10% in raw paddy

and 0.5 to 3.0% in Par Boiled Paddy) which the consumers not conversant with rather the consumers not made understood. 100% deshelling of paddy at 4% polish with high nutritive content and with negligible incidence of foreign matter, itself an asset for the Modern Rice Mill.

By products value of Modern Rice Mills could in no way be compared with that of conventional Mills. Sheller/Huller Bran will be received in a mixed condition with the husk of the paddy grain and is being sold as cattle feed on an average at Rs 6/- to 8/- per bag of 50 Kg. Bran, where as Modern Rice Mill Bran (which has got about 18% to 20% Bran oil in Raw rice Bran and 25% to 30% Bran oil in Par Boiled Rice Bran) is being sold to solvent Extraction Plants at Rs 20 to 21 per bag of 50 Kg. Bran. How could you imagine the difference.

The Husk which is about 22 to 25% of the Paddy grain has got immense value in it. All being under research, but proved to be successful ; this can be used for Alchohal preparation ; for making light weight fire bricks ; Husk when compressed at high temperature, and pressure, forms sticks which will replace the use of fire woods ; Husk may be used as coushening seatings and so many other utilities scattered in a wide range, which will be of much useful to the people in the below overage category, of India.

Inspite of all these assets the 13, Modern Rice Mills in Tamil Nadu (Since Tamil Nadu has made a headway in Modernising the Rice Mill Industry) under co-operatives has not made significant progress. The matter to regret is that these Mills had not been put in to use, even to the extent of 35 to 40%.

The National Co operative Development Corporation, New Delhi has financed for these Mills. This comes to about Rs. 167.5 lakhs.

Of course, there are some draw backs in keeping the mills, run, due to the increased cost of production, due to the low polish of the finished rice (Marketability) which could be avoided until the consuming people convinced with the Nutritity value of the 4% polished rice, procuring quality paddy from ryots who are very well conversant with paddy admixtures, and in getting 100% pure end products for want of minor improvement, in the machineries so as to suit to deshell our paddy which is difinitely different from the paddy for which these machines were designed etc , but one could never forget all such above said draw backs can certainly be minimised or eradicated then and there in a flash period with the skill of our Engineers on whose young shoulders these mills were now idle with their unboundless spirit by keeping the mill run which will automatically raise the said draw backs to remove them.

Nations capital amounting to the extent of about Rs. 170 lakhs under crisis, without no return, without using its employment potential with idling machires getting deteriorated ; could never be witnessed.

Quarters concerned may kindly get into the arena and see that those cobwebs are cleared soon.

GEAR CHANGING OF AUTOMOBILE

By

K. C. MATHEW, D.M.E., A M.I.S.E.

Carmel Polytechnic, Alleppey-4.

In these modern days even though thousands of cars, buses, scooters and motor cycles are playing on roads in our country, it is surprising to note that a majority of the drivers do not properly understand the implications of gear changing. The majority is inc'usive of both owners and professional drivers.

Good driving is not just avoiding running over pedestrains or avoiding bumping in to lamp posts. It is the clear understanding of the gearing system incorporated in automobiles.

To begin wlth, let us take anology of a tricycle which has a three-speed hub incorporated in it. When the gear shifter is pushed into the first gear position the rider finds that he is able to peddle freely and without much efforts. He also finds that the peddles move more number of times than they normally do while climbing gradients the relief to the rider is considerable. This is achieved by making use of the principle of mechanical advantage.

Let us suppose that a big iron gate is to be opened or closed. When we try to move the gate by holding it as near the hinge as possible, we find that we have to exert an enormous force. On the other hand if we hold the gate as far away from the hing as possible and then move the gate, we find that it will be very much easier than before. For the latter case we have greater leverage and hence a better mechanical advantage. Riverting to our tricycle analogy, in the first gear the peddles move fast enough to generate sufficient power to pull the tricycle from rest. By a judicious combination of gear wheels, a smaller gear wheel revolving at a higher speed, drives a trigger and slower gear wheel coupled to the hind wheel, thus giving the necessary mechanical, advantage to the system. In otherwords we have made the necessry provision for the engine, namely the peddles, to revolve at a faster rate freely so that it generates the necessary power to move the tricycle from rest.

Likewise, to start a motor vehicle from rest, the inertia of its entire weight must be overcome. A high percentage of all the power the engine has, is necessary to do this. But the gasoline engine does not develop its full power when it is running slowly, it has to be working fairly fast before it can develop maximum power and torque. Since enormous power is needed in starting, in climbing a hill, and in pulling a load, a means must be provided to permit the engine crankshaft to revolve at the relatively high speed which necessarily results from production of desired power while the wheels revolve at lower speeds. This is exactly what is accomplished by the gear box in an automobile.

The first gear is designed to pull the car from rest. As explained earlier, that gear

allows the engine to revolve at a higher speed, thereby developing the required power. Thus, on first starting, the gears are placed in low so that the engine crankshaft turns approximately twelve times for each wheel revolutions. The clutch is then engaged so that power is applied to the wheels car speed increases with engine speed until the car moving 10 or 20 K.M.P.H. At this time the engine crankshaft may be turning as many as 2,0000 r.p.m. The clutch is then disengaged and the engine crankshaft speed reduced, to permit gear changing. The gears are shifted in to second, and the clutch is again engaged. Since the ratio is now about 8 : 1, a higher car speed is obtained as engine speed is again increased. The car can be accelerated to a speed of about 40 K.M.P.H. But one important thing that is to be noted here is that the second gear has to be engaged quickly taking care to see that no time is lost while changing over. Otherwise the very purpose of having employed the first gear will be defeated. The gears are then shifted in to high, the clutch being disengaged and engaged for this operation, so the ratio between the engine and wheels will be approximately 4 : 1. In otherwords, the engine crankshaft will turn four times to cause the wheels to turn once. So the car gathers speed step by step till we arrive at a minimum speed in the top gear which has to be maintained under any circumstances. If this is not done and the speed keeping the car in the top gear the strain to the engine will be very high.

This is one of the reasons why most of our cars end up in garages for costly repairs like engine restoring, etc. Gears are meant to be frequently shifted and it is pity that many drivers do not do this.

Let us suppose that the car has to be driven in a crowded street. Here undoubtedly the second gear is to be engaged all along the entire road. Because 20 K.M.P.H. will be the safe speed under such traffic conditions. The fact if the traffic conditions demand that the speed is to be much less, then the first gear is to be engaged. Under no circumstance, should either the third gear or the fourth gear should be used, as these two gears are not designed for these low speeds.

Inspite of this we have run hundreds of drivers driving cars at 15 to 20 K.M.P.H. in top gear. It should always be remembered that each gear is designed for a particular speed. Just as the first gear is not designed to pull the car at 60 K.M.P.H.

Each gear has its own duties to attend to. Before the top gear could be engaged, sufficient momentum should be developed.

A majority of western drivers shudder even to think of driving their cars at 20 K.M.P.H. in top gear. They are taught not only the art of driving but also the working of the engine. In fact a good majority of our city roads do not allow to use the top gear at all.

Travelling at low speeds in top gear is like trying to run up a mountain. One can imagine the amount of strains that the heart experiences If on the otherhand we climb slowly and steadily, the heart works comfortably and supplies the necessary blood without much strain.

Even while going doing down a gradient a safe habit is to engage the car in lower gears. Of course, if the traffic conditions permit the car can definitely be driven in the top gear

but a speed which is not less tha MINIMUM speed required for that gear.

For Heralds and Feats this is round about 60 K M.P.H.

It is a mistaken notion that the second or the third gear should not be used for longer periods. In fact if the situation demands, as while climbing a gradient, second or third gear should be used throughout. In cities also, the same principle should be used. No doubt the petrol consumption is a little high but this will be amply compensated by the longivity and resale value of the car. While descending a gradient also, the same gear is to be engaged. Here the engine acts as a break, thereby effectively arresting the wheels from revolving at dangerous speeds. In cases of emergency all that a driver has to do is to take off his foot from the accelerator and the engine slows down appreciably. Then the breakes could be applied with telling effect. 10 H P. engine can either drive the wheels at that H.P. or it can act as a break at the same depending on whether it is accelerated or decelerated.

An engine is supposed to talk. If driven properly, the engine actually.....On the otherhand if it is ill treated, it pinks and groans. Pinking should be avoided altogether as it impairs the life of the engine.

The rhythmic humming noise of an automobile in correct gears can be recongnised by even a lay man.

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SCIENCE & ENGINEERING

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SCIENCE & ENGINEERING

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REMOVAL OF POVERTY

During the next five or six years the main task before our country will be the all important problem of removal of poverty. Removal of poverty and attainment of ecooomic self reliance are the two major tasks that the fifth plan endeavours will have to accomplish. To achieve this under a democratic political order, prevention of concentration of economic power and reduction of disparity in income and wealth along with balanced regional development, should be one of the major objectives of the fifth plan.

Though no doubt living conditions have improved in many sectors of the country, yet it cannot be denied that a large number of the population have yet remained poor. Existence of poverty, is incompatible with the vision of a prosperous advanced and egalitarian society, where justice plays an important part in the socialistic pattern of development. Poverty holds a potential threat to unity, and independence of the country. Hence elimination of poverty is a matter of highest priority.

Poverty in our country is not a new thing. It is a many century old curse, probably since Rama Rajya. Many factors have contributed to its continuance inspite of the fact that Indias' wealth in ages bygone was proverbial, and had attracted over centuries many political marauders and invaders, to sack the wealth of the country in various manners and forms. It was always a feature of the land that wealth was concentrated in a limited number of lands, and the average man was always poor. The British Rule did not alter the situation. On the contrary it processed a system of draining money out of the country, and most of the people were left below the poverty line.

Poverty level has to be defined in terms of minimum level of consumption. According to the Planning Commission's fourth plan document private consumption of Rs. 20 per capita per month was considered as the minimum desirable consumption standard. At 1972 prices, this figure will be Rs. 40/-. Thus elimination of poverty would seem to mean that a large number of people living below poverty line should have a minimum private consumption standard of Rs. 40/- per month.

However, the intensity of the problem and the proportion of the affected people vary from region to region. But in every region poverty is still a major problem. In fact in the underdeveloped world, this is a common problem.

It is a generally accepted fact that the twin causes of poverty are underdevelopment and in equality, and none of these can be underplayed. Effort to eradicate poverty cannot therefore be unidirectional. No rate of growth can make a major impact on the problem

if inequality remains as acute as now. Therefore growth and reduction inequality are indispensible to a successful attack on mass poverty

So far inadequate planning has been one reason for failure of planning to make a major dent on poverty in our country. The growth rate in dacade 1951—60, the first decade of planning, was only 3·8 per cent. Against a back ground of high rate of population growth even this small rate of growth in economy was practically washed out. The second decade 1961-70 of planning gave only a growth rate of 3.7 per cent. Against a continuing back ground of high population growth of 2·5 per cent, even during the fourth plan the rate of economic growth never exceeded 5·7 per cent in terms of net domestic product.

The Planning Commission envisages the economic growth will increase to 6·2 per cent during the next 7 years, 1974-75 to 1980-81, and 6 5 per cent thereafter. At the same time by an active family planning programmes the rate of population growth is intended to be reduced from 2 5 per cent to 1·7 per cent by 1980-1981.

The key note to the fifth plan endeavours and planning for elimination of poverty should therefore be adoption of a strategy resting on two major factors, a rising rate of growth of domestic products, combined with a declining rate of growth of population.

While a higher rate of growth than achieved in the past is a necessary condition for removal of poverty, it is not a sufficient one. During the fourth plan the pattern of inequality in consumption remained the same as before inspite of increasing rate of growth. Therefore a new approach has to be made. A high rate of growth should be accompanied by a particular composition that should especially favour the weaker section of the society.

Such a composition of the economic growth rate can be achieved by following a programme of massive employment and massive self employment. The former will be sustained by a much greater availability of goods and services of mass consumption, which apart from the organised sector, will be generated by the latter category of encouraged massive self employment. Special emphasis need to be given to backward regions and classes who should have their due share in rising production and expanding income.

Nevertheless poverty is too big and complex a problem which cannot be expected to be overcome within the span of a single five year plan. It is nevertheless heartening to find that the accent on the fifth plan programme approach is on initiating a strong drive against poverty.

However the best plans will not take the country to its objective unless a number of conditions are fulfilled ; foremost amongst these are a spirit of robust self reliance in field, factory and office, and discipline in all walks of life and activity.

ELECTRIC CURRENT IN HUMAN BODY

By

HEM CHANDRA CHATTERJEE

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Doctors who have specialized in surgery, should know the biological effects of the electrical current. Several doctors think that biological effects of electricity is caused by the voltage, but that is not true. The biological effects are directly related to the amount of current flow, not to the voltage. Biological effects can be easily detected on a human body if an electrical 50 Hz (or 60 Hz) source is applied and approximate 1 mA is required. These effects will cause a tingling waves. Tingling waves are increased when current is increased. Tingling waves hits the brain and br. in senses the pain and contraction of the muscles. Further increase of tingling waves cause more pains. Finally when current reaches its peak intensity, it causes severe effcts in body and one cannot release his grasp of the electrical source. Maximum current-intensity causes severe pain and muscles' contraction, exhaustion and fainting. This severe condition can be caused for an women by a current intensity of 10 mA and for a man approximately 15.7 mA. Ultimately when current intensity will reach above 40 mA, a heart of a week person fibrillates. If there is any absence of quick remedy, the final effects are marked by death. Flow of 50 mA current through the heart of a strong man can cause his death. But it is true that this effect varies from individual to individual. The above mentioned 10 mA and 15 7 mA thresholds are directly proportional to body weight and inversely proportional to the square root of the duration of shocking moment.

Nerves and muscles stimulation are caused by the current. These stimulations cause neural impulses which is transmitted to the nerve axon. If the stimulation is mild, tingling sensation appears. Maximum contraction caused by muscle fibres upon direct stimulation. Tissue exhibits a c. reactance or d. c. resistance. Generally tissue exhibits less impedance between 50 and 60 Hz. Although these frequencies are more suitable and popular throughout world, indeed they are most dangerous for the human body.

Muscular contraction is directly proportional to the current intensity in a body. If 125 mA passes through muscles ; the contraction is approximate eight times higher than the contraction is caused by 15 mA. The contraction will be so rapid that the muscles will automatically break the contact with the electrical source. This high current will cause less harm to the heart patient on an operating table rather than moderate currents

The local current intensity also damages the tissue. Current from its contact point to

the exit point gets broader front because the human body is a conductor. A little tissue with a small resistivity cannot withstand this high current intensity. This tissue may die or live which will be determined by the heart and central nurvous system.

In general metal is very good conductor with low resistance. Therefore, metals contain very high current intensities. Metallic catheters are usually used in several clinics for heart treatment. A little leakage within metallic catheters may cause the death of the patient

Injuries are also caused by thermal effects of the arcing current. Generally Arcing heat is proportional to the current intensity and specific resistance of the tissue. Skin is the usual point of entrance of the current and the soles of the feet are exits. Usually burn of the skin is too small because skin possesses greater resistivity of the tissues ; but burns on the soles of feet are bigger.

NEW ENGINEERING TECHNIQUE IN TRAFFIC ENGINEERNIG

By

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B.Sc , B E , M.I.E., M.I.G.S., M I R.C , M.I S.E , Mysore P W.D. HONAVAR.

ACCIDENTS take place for three reasons.

The FIRST reason is due to the person driving the vehicle.

The SECOND reasons is due to the mechanical defects in the vehicle which is being driven by a person.

The THIRD reason is due to the public going on roads-violating the traffic regulations.

It is very essential that new engineering technique should be adopted in traffic engineering.

Let us discuss the topic of accidents due to the person driving the vehicle. It is observed that the number of accidents is increasing on roads in India. The present practise is to put two wires on roads. The time taken by a vehicle is observed.

Before observing, the time required by a vehicle to travel, the distance should be calculated. In case the vehicle crosses the second wire before the calculated time, then police will chase the vehicle, and book a case for having driven the vehicle above the restricted speed.

When once a case is booked against one vehicle, persons who are driving vehicle and

following this vehicle will come to know that Police will book case against them.

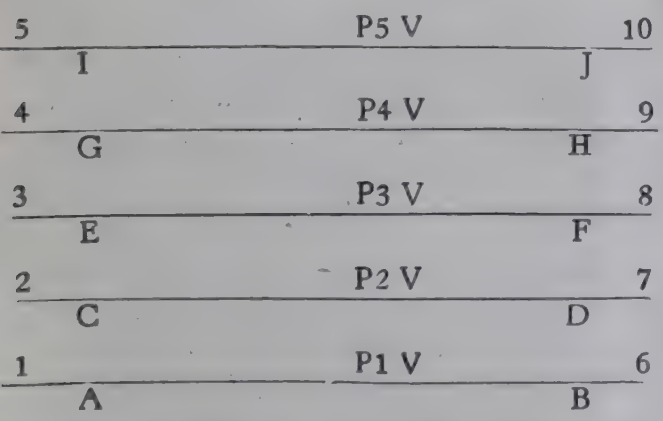
So they will become alert and will try to cut down the speed, to the restricted speed.

Hence the Police will not be able to book a case against them persons who drive vehicles above the restrict speed. The technique can be thought of, as an experimental measure and if it is successful, and it is found practically possible by the traffic department to introduce this new engineering technique, then it can be implemented in such points in big cities during peak-hours.

The new engineering technique in traffic engineering is based on the combined principle of the scismograph and television camera and rador equipment and tape records.

It is prohibitively costly for our Indian traffic condition. The new engineering technique is as follows :—

Five wires at right angles to the direction of road will have to be placed on the road surface at suitable distance,



AB, CD, EF, GH and IJ are 5 wires laid on the road surface at right angles to direction of road and connected to each other at both the edges.

Suppose a vehicle V crosses the wire AB immediately vibrations, due to vehicle passing over the wire will be communicates by the wires AB to the wire CD, EF, GH and IJ.

Suppose the vehicles reaches the wire CD, in an interval of times T_1 which is less than the time T_2 which should have been taken by the vehicles if it had travelled at restricted speed, then, it is definite that the vehicle is going beyond the restricted speed. There will be a rador and scismograph connected to the side wire 1-2-3-4-5 and 6-7-8-9-10.

When the vehicle goes above the restricted speed the rador will automatically communicates the vibrations to an excitor which is ultimately attached to a circular plate, at wire EF.

There will be a stop signal which will automatically illuminate by battery at the back of circular plate. There will be television camera attached to plate when vehicles goes beyond restricted speed automatically the stock signal will be illuminated.

So, the vehicle will stop on EF. Television camera will automatically take out photograph wherein the number of vehicle, and also the photo of the person driving the vehicles will be recorded. Television camera is fixed to the plate whose bottom is connected to point E on the ground. There will be another stop signal 'STOP' then the vehicle will stop.

The last wire IJ is also connected to wire GH. Police party will be waiting like public in civilian dress secretly so that the common man on the road will not know that they are officials of police department waiting to book cases against persons violiting traffic regulations.

The police will give wireless message to the mobile court party. So a case will be booked on the spot. Summary enquiries will be held, on the spot, and judgement will be announced on the spot.

Every person who is fined will have to pay the fine on the spot and also he has to pay a nominal charges towards the expenditure incurred to book the case.

Expenditure includes the cost of taking out the photograph+50% of that cost towards the capital cost of the television camera Scismograph and other equipment etc.

Fine to be imposed is based on the nature of the violation of traffic regulations type of vehicle etc.

If the party refuses to pay fine, vehicle should be take to police custody. Receipt should be given to the party. The party should take the vehicle after paying the fine from the spot where it was parked. Till then there must be a watchman at the spot for safe custody.

If there are serious accidents resulting in death or serious damage to vehicle, mobile court will book case, regular court will conduct the case. As far as possible, obstructions to running traffic should be avoided by closing part of the road to traffic.

So I would like to suggest that the traffic engineering department should conduct this test in the highway research station, Madras, or the Central Road Research Institute, New Delhi if not already done.

The cost of the scheme should be worked out. Statistics of the number of cases, booked during 1971, till September '72 should be found out.

Of course my ideas may not be new, and it may be already being adopted in foreing countries. In order to prevent, minimise, number of accidents in India, some ideas have to be implemented.

According to statistics of accidents in Mysore State for 1958-67, 71% of accidents have occured due to the fault of the drivers and 6.3% of accidents due to pedestrians 8.7% due to mechanical defect, and 14% due to road-way.

In Mysore State there are 3 deaths on an average daily, according to latest statistics compiled by police department.

Pedestrians are the maximum sufferers. 40% of those killed and 37% of those injured come from the class of road users. Number of accidents in Mysore State has been doubled over past nine years to 6200 reported last year. Death toll due to accidents has risen from 530 to 1200. Goods vehicles accounted for 30%, cars 19%, buses, 18%, motor bicycles 7%.

In 47% of accidents over past 10 years the drivers of motor cycles have been the cause. In Bangalore city there are 66,000 vehicles today and there is corresponding increase in number of vehicles passing through the city.

In India there are 8 accidents per thousand vehicles. In foreign countries like UK, USA there will be one accident for 1000 vehicles. Even though number of vehicles in foreign countries are more than that of India. It is estimated that there is a loss of 20 crores rupees a year for the country.

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SCIENCE & ENGINEERING

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EDUCATED UNEMPLOYED

The Fifth Plan Draft has accepted that the general policies for expanding employment opportunities will have to be supplemented and coordinated in the specific programmes to draw the educated unemployed into productive activity. For this purpose, in the Plan frame a distinction has been made between the skilled categories and the generalists.

The doctors and the para-medical personnel present a relatively easy problem, as the health, family planning and nutrition programmes are expected to absorb all available medical and para-medical personnel. The veterinarians and the agronomists also present a manageable problem. Crop and animal husbandry will absorb quite a substantial number of agronomists and veterinarians.

The solution for fuller employment of scientists, engineers and technicians however presents a more formidable problem. It is dependent on an upsurge of industrial growth and vigorous expansion of productive reserves and development activities. It is only if the envisaged rate and pattern of industrial growth materialises, and if R and D activities do expand as may be chalked out, that the unemployment amongst these categories of skilled persons can be expected to cease as a problem.

The programme for encouraging engineers and other technical people to set up their own undertakings has not yet yielded any appreciable or hopeful results. Efforts should however continue with experience gained, as this is a sector which is not only vital for wellbeing of a large number of technically unemployed but is also a vital sector for national wealth production.

Regarding generalists, it is to be borne in mind that their number has been allowed to grow out of all proportion to the needs of the economy and their ranks are swelling at a rate faster than the rate at which employment is created.

At the end of June, 1971, the employed educated numbered 5—6 million persons in the Public Services, Administrative and Social Areas. The annual increase is of the order of 125,000 persons. Obviously, such a large annual growth rate of educated unemployed cannot be fully absorbed in these services. Hence a large sector of them has to be diverted to commodity producing sectors by helping them to acquire specific skills and by suitable policy changes.

Again, a sizable segment of the poor comprise of property-less unemployable—like widows, orphans, the aged, the infirm, the invalid, the handicapped and the derelict. They do requires social assistance. But where ever possible, they should be encouraged and aided to engage in production activities for which homes can be set up. It is good that the Fifth Plan has laid stress on these aspects.

SOLIDS PIPELINE, A REALITY

By

A. CHOUDHURY, B.A, T.Eng. M.I.T.E., A.F.S., M.I S.E.

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Gone are the days when pipelines as a medium of transportation, were limited to Gases and Liquides. Pipelining Technology for Gas & Oil has become nearly a conventional Technology, with improvised methods in day to day Design, Construction and Operation. The major problems that are yet to be ironed out in this area, are the transportation of LPG & LNG through this medium successfully and effect of 'Permafrost' (Arctic ground conditions) on Pipelines. Extensive research and experiments are being carried out in these directions and the days are very near when the Technical feasibility under these conditions for these commodities will be in the hands of Pipeline Technologists, Engineers and Researchers.

Liquids and Gases have travelled millions of miles in bulk quantities throughout the world. In these days of rising costs and international competition, it has become imperative to think about transportation medium for solids which is cheaper than conventional mode. On sea, high tonnage freighter is the solution, in land, Pipelines. Of course, some may term the concept of transporting Coal, Iron ore, Limestone, etc., by pipeline as fantasy, but it is a reality.

There are many solids Pipelines around the globe and to name a few (a) Black Mesa Pipeline, 273 miles long, Commodity, Thermal coal, Annual throughout 6.00 Million Short Tons per annum. (b) Savage river, 53 miles long, commodity, Iron ore, Hematite, annual throughput 2.25 million short tons.

Design :

1. Hydraulics :
   (a) Water is the vehicle for solids transportation in most pipelines in operation now. The characterstic of the flow is normally considered and is hetero-

geneous and non-Newtonian, depending on the particle size distribution, particle size and slurry preparation.

(b) The bedding velocity or Critical flow is the rate of flow of the slurry in which the particles remain suspended, below which the settlement in the pipe begins.

(c) The designed flow or velocity should be such as to negate the bedding point.

(d) Quite a few things are considered before the optimun velocity and through-put could be designed. Although there have been lot of formulas and mathematical equations based upon various laboratory observations, experience plays the vital role in designing such a venture. Among other things the following critical points are considered to make a pipeline work economicaly and smoothly :—

x. Particle size in the pipeline.

y. Slurry preparation, i.e. ratio of solids and the vehicle, in this article, water.

2. System :

High velocity of the solids tend to erode the wall of the pipe. Abrasivity of the solids varies with the size of the particle and concentration of slurry. So, the wall thickness is overdesigned as precautionary measure as compared to oil and gas pipelines. However, the abrasavity of the thermal coal 325 mesh below with 50% slurry concentration, by volume, has been very negligible, whereas, iron ore of the same particle size has been about 30 in Miller number. However, this abrasivity does not pose any threat to pipelining.

3. Pumps .

Although experiments have been conducted in the past and more experiments are being carried out now at the moment to pump lump coal in the size of 1" below, the probability of such cross country transportation through pipeline is remote, for the fact, that only centrifugal pumps can handle this particle size and centrifugal pumps do not have high 'hydraulic head' and casings of the pumps can take only a limited pressure. Although centrifugal pumps have been used for number of solids pipelines of smaller length but reciprocating or positive displacement pumps are certainty for solids pipelining used for bulk cross country transportation.

4. Receiving Terminal :

The end product of a slurry pipeline can be fitted very suitably with a production system. For example, in a thermal coal pipeline, whereas, the coal passes through pulverizers from pipeline of course after dehydration, the water is used for condensate water make up system in the thermal power station. Many uses can be visualised and most economically utilised by the end product of a slurry pipeline.

In upgrading the quality of raw iron ore the ore is ground, washed and pelletised with a mixture of 'Bentonite', thus upgrading a ore from 29% Fe contents to 60 to 70% Fe contents. In the whole process there are heavy consumption of water. Whereas, the crushing and slurry mixing for iron ore may be done at the input of a pipeline, pelletizing can be done at the end of the pipeline thus serving the dual purpose of transportation and upgrading.

4. Economics :

Since the solids transportation becomes a part of the process, the economics of the solids transportation in the areas where there are no other means of cheap transporation, has never been questioned by pipeline. Every technical approach has certain limitation and so is the solids pipelining in respect to gradients of the terrain. So, the capital investment of a project and ROI is very much dependent on the following factors :

(a) Physiography
(b) End use/End product
(c) Quantity
(d) Distance

Other Vehicle :

Although water has been the most common carrier for solids, so far, research has been undertaken to use liquid hydrocarbon as a carrier. Although this is feasible but economics of the whole system has not been proved out yet.

Marcona Flow :

Although there have been a patented system of Pipeline transportation, known as 'Marcona flow' in U. S. A., where iron ore slurry is straightway pumped into ship's port hole and dewatered, unloaded at the destination by slurification again at unloading point, the Japanese have not accepted the process of reslurrification at unloading point and they use conventional unloading processes. But this process as known 'Mercona flow' is nothing but solids pipelining in another name and working technique.

Conclusion :

Utilisation of this medium of transportation in India can be very well visualised economically. Personal experience in Iron ore mines and colliery has found the following wastages of natural resources :—

(a) Iron ores having less than certain percentage of Fe contents (which is definitely higher than 30 to 40% Fe contents) are just dumped aside at mine side.

(b) Crushed or dust iron ore or iron ore having a lump size below the contract specification, although may have a high Fe contents are just dumped aside and not utilised. Using iron ore as a road bed material are not within the category of utilisation, in this articles.

(c) Coal dust in collieries are burnt by miners in winter months for warming up or just burnt out by the colliery owners for making the end product usuable for colliery Civil works maintenance.

Developed countries, like Canada and Australia with natural resources are selling iron ore deposits having a Fe contents of 29 to 30% in much larger quantity than India and presumably in much more favourable price in the world market. If these countries with average Fe contents of 29 to 30% in iron ore can upgrade the final delivery to Japan with the combination of transportation and upgrading to 60 to 70% Fe contents and compete with the world, isthere any good reason why India can not ? Particularly when, India's iron ore deposits as exploited so far are much higher in Fe contents ! (The writer happens to know many officials of MMTC and the process of shipment and working of grading of iron ore at Japan). Dust coal from the colliery can be utilsed for thermal generation with a net work of Pipelines.

TYPICAL PROBLEMS TO THE DISPOSAL OF SEWAGE FROM ISOLATED BUILDINGS AND SMALL COMMUNITIES.

By

S. M. SARKAR, M.I.S.E.

It has been all the times necessary to dispose sewage locally when there are isolated buildings or small communities served with adequate water supplies, but located far from the built-up areas or the like.

1.2. When the houses are evenly distributed over a larger area, drainage through sewer or mains is worthy of consideration, because the methods of disposal of sewage from isolated buildings are problematical, less satisfactory than main drainage, naturally the relevant work also becomes expensive.

1.3. Normally, small sewage treatment work or Cess-pool drainage are adopted (or provided with) for the disposal of sewage from houses or small collections of buildings with water-borne system of sanitation. But in case of insufficient water-supply, there should be no water closets, and conservancy methods can be introduced for soil sewage ; Sullage treatment can be advised for the rest.

2. Conservancy Sanitation.

2.1. Ancient type of privies were "Holes" dug in the ground, with seats and wooden houses fitted over them. The hole being filled up, a separate one would be introduced.

2.2. Then an improvement was there for introduction of removal 'Tubs' (earthen, and later on wooden) which were and are used to be removed or cleaned during nights by public authority : and this was the origin of the term 'Night Soil'.

2.3. Privies are the primary sources of water borne disease. Earth closets are less dangerous because the covering of the faecial matter with earth or ashes prevents the access of flies to a great extent.

Statistics has shown that water closets are much more sanitary.

3. Closet Provision.

3.1. Provision of water closets should have been in all the premises, but which is not possible all the times for the reasons—

a) As not satisfactory in the absence of adequate water supply.

b) As per P. H. Act of 1938—"which sewer is not available it is not to be permitted".

3.2. Earth closets must have movable receptable for faecial matter and provided with deodorisation by means of earth, ashes, chemicals or other methods.

3.3. This way, a chemical closet with a movable receptable also falls under the definition of an earth closet. Normally a chemical closet consists of a container for the excreta, chemical and a seat with a lid. Capacity varies from 3 to 5½ galls. (14 to 25 litres).

3.4. A water closet has a fixed receptable connected to a drainage system (sewer) and a separate provision for flushing with clean water.

4. **Installation and Care.**

4.1. The inhabitants are responsible for the proper maintenance of their closets and checking should be there for proper deodorising materials for a earth closet or a chemical closet.

4.2. The room in which an earth closet is placed should have access to the external air, and the room must not be used for habitation or for preparation of or storage of food.

4.3. Overflow or soakage must be stopped and taken care of all the time. It is on record that such occurrence could legally be considered a cesspool and local authority have the power to penalise the owners.

5. **Chemicals.**

5.1. Normally, coaltar preparation with or without oilseals, and formaldehyde preparations are used for the purpose where oil seal prevents evaporation from the surface after having been disinfected.

The fluid should be capable for a storage period of one year without deterioration.

The chemical should be free from injuring materials to the closet e.g. caustic soda or the like.

The germicidal effect of infectious uses in chemical closet should not be exaggerated as they are intended for deodorisation and not to sterilise.

6. **Disposal of Closet.**

The common method for the disposal of the contents of earth or chemical closets is removal at a maximum interval of one week by means of removing vehicle with tank and vacuum pump and hopper filled in it. The contents of these cesspool-emptiers should be discharged to nearby sewers to be treated with a larger type of sewage treatment system as not to be affected by the disinfectants.

7. **Some Precautions.**

The cesspool emptier should never be discharged on the lands. It might have been possible that no harm was there in a particular place, but there are reports of considerable nuisance caused by such materials soaking into the ground and infiltrating public water supply systems by contamination.

Often one may be using the closet contents as manure in the garden, pouring it into shallow trenches or covering it up. Here again, it endangers the public or other wells by contamination.

8. **Drainage to Sullage.**

The disposal of sullage from kitchen, sink and clothes washing etc. should be properly conserved, where it endangers the water supply, that is, to be prevented.

These can be disposed far too frequently by soakage into the ground. The idea that, the sullage from isolated premises are not containing serious contaminating liquid, is not correct as it contains faecial matter from washing of napkins and from slops etc.

9. **Cesspool Drainage.**

Cesspools are usually circular on plan, constructed by brick works or precast concrete tubes. The floors are flat, roofs may be dome like or slab type. Access is by a short shaft covered by a heavy or medium manhole cover.

Cesspools were very commonly used for isolated houses and small school or institution throughout the western countries. But it is rather expensive to maintain and deal with sewage.

10. **Sewage Treatment Works for Isolated Premises.**

10.1. Isolated building having good water supply should have their own sewage treatment works. The methods of sewage treatment generally resemble what is used at municipal works for percolating filter treatment, land treatment, septic tank etc.

10.2. It is often advised to provide separate system for the drainage of isolated buildings and communities. In such case the sewage is strong and will not contain much grit and provision of screeninr or separated grit removal is not required except for a working of sufficient size.

11. **Septic Tank.**

11.1. Septic tanks are introduced where no underground drainage is available.

It must be used in connection with water closets equipped with adequate flushing system. The sewage, after flushing is led from the lavatory along the soil pipes into the receiving chamber where, by the bacterial action, a system of purification is set up converting the organic matters in the sewerage into liquid and gases which are discharged through the outlet. This effluent should be charged into a soakpit or trench which should be closer than 50 ft. to an underground source of water supply like well or short tube-wells.

11.2. Cautions thereto.

The use of disinfectants or antiseptics, such as concentrated soap water and phenyl, for cleaning the lavatory or the septic tank should be discouraged, since the effect is likely to be injurious to the bacterial action of the purification process.

12. **Conclusion.**

The problem of disposal of sewage from isolated buildings or group of houses can be solved by selecting the economical, effective and thereby a healthy system after judging the relevant merits and demerits in detail, keeping an eye to unemployment and labour unrest slogans.

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PRESIDENTIAL ADDRESS

By Shri U. P. MULLICK to the Annual Social on the occasion of the 39th Annual General Meeting of the India Society of Engineers, held on August 4, 1973.

Our Chief Guest Shri Bhola Nath Sen, Shri P. C. Bose and Friends :

On behalf of the India Society of Engineers, I welcome you all to the Annual Social of the Society on the occasion of its 39th Annual General Meeting and Dr. B. N. Dey Fourth Memorial Lecture to be delivered by our distinguished friend Shri P. C. Bose, F. N. I.

Appropriate to the occasion I would like to speak to you a few words on a subject of great interest, that is at the moment probably agitating most of our minds, namely, on India's Fifth Plan objectives, — at a time when our country is shortly going to enter the Fifth Plan stage.

Plan Objectives : To plan its objectives, the Planning Commission has laid great stress on two aspects. The first is that the employment scope in the country should be developed to maximum capacity, to give employment facility to our millions of young men, the new entrants into the life of the country. The second objective is the industrial development of the country with maximum resource development compatible with our own resource and capacity for shouldering the burden. In other words, the Commission has taken the course to raise the level of income of the mass of the people and to take the country from the border line of poverty to a 'take off' stage to affluence, by laying the greatest stress on employment, industry and agriculture.

Employment Scope : These three are interrelated aspects of the economic life of the country. Widening the field and scope of industry and agriculture leads to widening the avenues of employment. We must remember that the expansion of the administrative machinery to cope with expansion of industry and agriculture is inevitable, but it has its hard limits as regards capacity of absorbing new entrants into the administrative and white collar services. Hence the country has to fall back on industry and agriculture to give increasing employment scope, so that our people are happy, contented, have security of life and a compatible level of income, discontent is minimum, and a great mass of people become self-employed.

Infrastructure : Now to plan successfully a programme of industrial and agricultural development, the infrastructures like power, electric, diesel and hydel, water supply, air, rail, road and water borne transports, net work of roadways, railway engines, coaches and rolling stocks, shipping tonnage and tonnage of automobile and other transports have to be expanded ; to increase the supply of raw material resources the metal and mineral resources of the country will have to be expanded to considerable capacities.

Order of Plan Investments : In the Fifth Plan, the investment proposed by the Planning Commission and approved by the Union Development Council and the Central Cabinet of Ministers is of the order of Rupees 51,000 Crores, nearly two and a half times more than the investments of the 3rd Plan. The investments during the previous Plans were successively stepped up by two times, but during the 5th Plan due to a rise in intensity of development, and need for rapidly generating the employment scope, which have both an economic and political bearing on the mass of the people, it has been considered expedient to step up the investment by two-and-a-half times.

Mainly this time, the success of the Plan, the 5th Plan, will be measured by its success in generating the requisite employment capacity in the country. This employment scope is to be obtained in the categories of Firstly, in services, whether in administration, industry or in agriculture or in defence, and air and marine and other services. Secondly, in self-employment in management of running industries and entrepreneurship in development of industries, in manufacture of machinery, plants and equipments and ancillaries, in the infrastructure ramifications, in process engineering, technology and R & D activities, Thirdly, in resource development, in agricultural expansion and its secondary resource dependency in fertilisers and chemicals, and transports, distribution and storage.

The 5th Plan frame has laid great stress rightly on expansion of consumer industries, which was neglected in the earlier Plans. Price rise is a demon that has increased its baleful activities in the rising Plan investments. It has eaten up a major part of the capital investments. To counter the same and check price rise and inflation, the 5th Plan proposes to

flood the home market with home made consumer goods, and with a sufficient supply of rice and food grains, more often at controlled prices through checks and adequate procurement policies.

We thus come to the basic problems again, namely, to increase employment scope and check price rise, heavy expansion of consumer industry is inevitable, along with development of basic and heavy and medium industries, and development of infrastructures, whether in industry or in agriculture, and this is inevitable. Similarly pressure of population has to be met.

Planning infrastructures : To Plan for expansion of infrastructure, it is necessary to adopt the following methods of planning, namely (1) Regional Planning, (2) Metropolitan Planning, (3) Urban Planning, (4) Rural Planning.

Regional Planning : In Regional planning, advance planning has to be adopted for development of power, water, transport, and drainage and road ways. Advance planning for power for industry, power transmission to village, and urban and industrial centres, power for agricultural pumps and power for lighting the urban and rural areas has to be considered.

In Metropolitan planning, to meet the demand of rising population pressure, internal development, including re-development of blighted areas, and peripheral developments come under consideration. While the internal re-development has to be taken serious consideration of, arterial road net work, traffic facilities and the increasing heavy pressure on daily commutation to work-site and back, need consideration and planning; the peripheral developments have to be taken in hand, model satellite concentration of population, model development and siting of industries to reduce commutation and increase work scope and peripheral and arterial road net work and transport facilities have to be worked out. Adequate power, water, transport sanition, drainage and sewerage facilities are also integral aspects of rural developments. These developments while relieving population pressure, also lend to economic development and mass employment.

Urban Planning : In urban planning regional aspects again come into planning. Locating the urban growth centres, urban industrial complex developments, industrial Estate developments and township developments and re-developments are integral aspects for such planning, which call further similar necessity for planning for their own similar infrastructure facilities. One important aspect of urban planning is its regional aspect, namely consideration has to be taken for backward areas or districts, so that benefits for power and other infrastructure facilities, for industry, and mainly for employment scope are made available to these backward areas, which have been neglected for ages, and this has its political bearing also.

Rural Planning : In Rural planning developments in irrigation through lift irrigation, tube-well irrigation requiring diesel or electric pumps are integral facilties which require adequate advance planning and development, coupled with economic credit facilities. For expansion of agriculture, more areas have to be brought under power tillers and tractors or improved modern agricultural implement use; keeping an eye on maximum 2 Crop—3 Crop facilities, research and development on seeds, and secondaries like fertilisers and soil testing, and rural repair workshops facilities have to be extended. All these call for advanced planning for agriculturural technology, and decrease in wasteful months for rural labour, re-employment of otherwise wasted hours to fruitful industrial work, develpment of rural industries, and mainly increasing the employment scope for rural labour force. This also leads to a check in flow of rural labour to urban concentrations.

Consulting Services : But all these development of industries and raw material resource development, require newer technology, and supply of adequate consultancy services for the development of industries and their infrastructure facilities and for urban and rural planning and expansion of exports. The 5th Plan therefore has laid great stress on development and employment of adequate consultancy services without which it will be difficult nay impossible, to increase industrial development, to plan for infrastructure, and to plan for urban and rural developments or to increase the employment scope in the country.

The 5th Plan has to guard against pit falls and develop and deploy all these resources, which in fine means less dependence on imports.

I therefore request Shri Sen that his Government do make the maximum use of Indian Consultancy and Technical Services available within the country and also within this Society for the purpose of accelerating the economic development, particularly in this State.

Gentlemen, I have taken much of your time, I am afraid. I thank you for your patient hearing. I thank you all.

CHIEF GUEST'S ADDRESS

Text of Speech Delivered By Hon'ble Shri Bholanath Sen, Minister of Works, West Bengal, at the I S E Annual Social on August 4, 1973.

Mr. President, Ladies and Gentlemen,

It is a great pleasure to me to address such a gathering. The economy of a country is mostly dependent on her Engineers. To-day, the economical condition of the conntry is on the brink. The way-out must be sought by the Engineers of the country in introducing a fruitful scheme for upliftment in order to achieve the goal. A sum of Rupees Fifty-one Thousand Crores has been allotted in the Fifth Five Year Plan. I am sure, the Centre will keep on giving us the required sum of money if the State, will step up with a fixed Plan. But whatever money may come to the State Exchequer, either by the Centre or by the State, the development of the country, I think, will prosper if the people will come in line, which is necessary because our abilities are not only forceful but also unlimited in comparison with vast problem of the day. I am also sure, if the planning is designed properly and executed in such a manner which will be conducive to the betterment of the people, the country must prosper.

What has happened in the past in India ? It is our revolutionary Engineers who had collected materials from the various parts of the land and put the wheels of our engineering development running no less inferior than in any other quarter of the world. We have heavy electricals and all other kinds of materials which do not immediately give return ; but it is obvious that it will give results in the present generation.

It is true that we have various problems to meet with our limited resources. We have Planning Councils. There are so many discussions and recommendations, the merits of which are being examined and considered. We are trying to evade the difficulties which may come in the way of our progress. Assessment of the past and the present have made a great difference. Let us take the case of Japan and Russia. What they were in the past. To-day, it is their Engineers who put these nations in such an economically and technically advanced position.

Not only in the case of big Planning but also in the case of domestic progress we must rely upon ourselves without looking for any foreign assistance. We have to consider, we have to judge as far as possible and as far as practicable the course of engineering and technical development of our country capitalising the magnificient activities of our Engineers which will obviously pay a high dividend in the progress of India. Though the Soviet Russia had sought foreign assistance after revolution, they are solvent in themselves now. They do not require any foreign assistance in the engineering field. I am absolutely sure about our Engineers that they are quite capable of doing good to the nation where scholars of very great importance like Meghnath Saha, Acharyya Prafulla Ch. Roy, Jagadish Ch. Bose and so many eminent scholars had performed so many great achievements and researches which nobody can do.

It is possible and only possible because of the high skill of our Engineers. I am convinced that our Engineers possess the equal standard of knowledge and intelligence with the rest of the world. Now I am a Minister of this State Cabinet. Next time I may not be a Minister. But it will be a solace to me that our Engineers are taking initiative to get the absolute prosperity and happiness like those of Russia and Japan who were totally handicapped before, now the world's most economically and technically advanced and powerful nations with the active help and co-operation of their Engineers in formulating just and correct Planning.

DR. B. N. DEY MEMORIAL LECTURE

Delivered by Shri P. C. Bose, F. N. I., at the Annual Social on the occasion of the 39th Annual General Meeting of the India Society of Engineers on August 4, 1973.

I thank the President and members of India Society of Engineers, for the privilege conferred by inviting me to participate in the 39th Annual General Meeting of your Society and being called upon to deliver Dr. B. N. Dey Memorial Lecture. Dr. Dey was a great Engineer of International repute with amiable personality, a great patriot a man with foresight and vision and above all a great humanitarian.

The degree of Doctorate in Science (Engineering) was conferred on him by the University of Glasgow for his thesis on Reinforced Concrete and its practical application in construction of Gasholders and barges, during the 1st world war, when steel was in short supply. University of Glasgow is well known for its high standard of academic achievement where world famous professors like—Lord Kelvin, James Watt, Ranken Goudie, Grey Gibson and many others imparted education and were on the board of examiners at one time or other. As such conferring of Doctorate Degree in Engineering on a young practising Engineer is an unique honour of which we as an Indian are all proud of Dr. Dey had been practising as a Consulting Engineer in London till 1929, when, at the request of Corporation Stalwarts like Late J. M. Sengupta, Sarat Chandra Bose, Nalini Ranjan Sarkar and others he came to Calcutta and joined the Corporation of Calcutta as Chief Engineer on 31. 7. 1929 in the leave vacancy, for a period of four months only. On resumption of duties by Mr. J. R. Coats—the permanent incumbent. Dr. Dey was appointed special officer Drainage, and in that capacity he served the Corporation till October 1933.

At that time water supply augmentation scheme known as Bateman Moore Scheme was practically completed but serious congestion in sewerage and drainage was engaging the attention of the Corporation and that of the Department of Local Self Government of the State. The out fall river Bidyadhari, which joined Peali and Matla—was deteriorating fast and bed level rose above the discharge level. The Government in the Irrigation Department took up dredging of the upper reach of the river Bidyadhari from Pratapnagar to Dhapa Lock. This met with disastrous result. The deeper section at the upper end induced greater volume of heavily silt laden water from lower region

to enter the channel resulting in deposition of much larger volume of silt in the excavated channel. The deposition of silt in the channel was so heavy that by the time the dredger reached the dead end of the river popularly known as Central Lake Channel the dredger could not navigate back and had to dredge its way out to reach the destination where she used to be docked. The Government was seriously purturbed as death of the river would mean serious delay in bringing in produce from the Sunderban area, with consequential loss of revenue and almost an unsurmountable difficulty in disposal of sewage and storm water of the City of Calcutta. The Government set up an Expert Committee to devise ways and means to resuscitate the river.

The report of the said Committee was submitted to Government in 1926 and copy was sent to the Corporation of Calcutta for their opinion and acceptance.

The Corporation in its turn set up a committee to go into the report. The report stated interalia that as the Spill area of the tidal river has been gradually diminished by premature reclamation of land by throwing embankments on both banks of the river, and with construction of eastern canal system and Dhapa lock, tidal water could not spill into Northern Salt Lake area. The final death nail was put in 1910 when Kristopur Canal was excavated to join the eastern canal system. The function of the spill area is well known. It receives Silt laden river water during the flow tide—when silt is deposited on the spill area and during the ebb tide comparatively silt free water finds its way into the river which also removes some of the silt deposited on the bed. During the monsoon rain water which precepitates on the spill area finds its way into the river and flushes out all the silt deposited on the bed and thus the life of the river is prolonged. On this analogy I expect the Expert Committee recommended acquisition of the Northern Salt Lake—deepening the same and leading river water into the same during flood tide and discharging the silt free water into the river during ebb tide. It was proposed a small dredger would be kept in the lake to remove the deposited material. The Corporation rejected the Scheme on the ground of high capital and recurring cost and as there was no guarantee that this Scheme would be successful in resusciating the river Bidyadhari. The Corporation asked their Ex. Engineer Drainage, Mr. O. J. Wiekinson, to prepare both Internal drainage and outfall Scheme, for efficient drainage of the City.

An internal drainage Scheme was submitted, but before the outfall Scheme could be prepared he fell seriously ill and left the country. At this crucial stage Dr. B. N. Dey was brought into the picture and I had the proud privilege of serving under him from 31 July 1929 till 14. 10. 1943 when he retired from the post of Chief Engineer. He was not only my 'Guru' but a friend, Philosopher and guide.

The Internal main Drainage Scheme was submitted to the Government in 1933. The Scheme envisaged renovation and augmentaiton of the two major Drainage Pumping Stations at Palmar's Bridge and Ballygunge. Construction of 9′-0″ dia. and 8′-0″ dia. High level Brick sewers from Palmar's Bridge and Ballygunge respectively to point A at Topsia, increasing the capacity of the dry weather flow channel from Topsia to Bantala, extension of

the 10′ dia. intercepting sewer from Halsi Bagan to Lock at Baghbazar along Canal West Road, and construction of storm sewers in Vivekananda Road from its Junction with Chittaranjan Avenue to Jagannath Ghat Road and other modifications, additions and alteration to the main sewers in the city. It was decided to pump all storm flow at Palmar's Bridge and Ballygunge. Sewerage Scheme for Maniktala with a separate pumping station at Dhapa Lock was provided in the Scheme. The Scheme received the approval of the Government after many discussions and deliberation without any substantial change. Execution of work was started in 1935 and practically completed by 1942. The work was somewhat delayed due to shortage of steel and other building materials on account of the 2nd world war—most of the materials being diverted for Air Raid protection and other defence works.

The selection of outfall was a very difficult and extensive river Survey work was necessary. Several alternatives were considered with outfall at river Hooghly near Budge Budge, outfall at Peali or Matla and outfall into river Kulti. Hooghly river outfall was discarded on the ground of excessive cost due to draining the city against the life of the land and above all from Public Health point of view. The outfall into river Peali or Matla was also rejected as both the rivers showed signs of rapid deterioration. The only probable outfall left was Kulti which was more or less stable. The outfall drainage Scheme popularly known as Dr. Dey Drainage Scheme was submitted to the Government in 1934. Government desired that the total volume of sewage and storm water should be fully treated. Government also forwarded a scheme of reviving the river Bidyadhari prepared by the then Chief Engineer in Public Health Department, Government of Bengal. The Corporation did not accept any of these suggestions. Government thereafter established an Expert Committee with Chief Engineer—Irrigation, Chief Engineer—Public Health, Dr. Dey, Chief Engineer—Calcutta Corporation and Executive Engineer—Drainage, Calcutta Corporation. Technical aspects of the Scheme submitted by the Corporation and suggestions of Government were deliberated upon several days.

It was unanimously decided that full treatment of sewage was not needed at this stage. The sewage would be settled at Bantala—and clarified sewage would be discharged into the river Kulti through the Dry weather flow channel. The Scheme of revival of the river Bidyadhari, as suggested was found to be not feasible. The Scheme as designed by Dr. Dey was approved by the Government in 1936 and by 1938 the storm water channel from Bantala to Kulti with sluices at the river end, several cross drainage arrangements with cart and foot bridges were completed. The Irrigation Department lent a dredger to the Corporation which excavated a 200 ft. wide channel 14′-0″ deep from Bantala to Kulti a distance of seventeen miles in less than two years. By October 1943 the two largest sedimentation tanks were completed. The plant was designed by the Corporation Engineers and the project was executed by a Calcutta firm of Engineers & Contractors with indigenous materials. Thus the city was saved from being drowned in its own sewage as was envisaged by many reputed Engineers in the middle twenties and early thirties.

Dr. B. N. Dey was appointed to the post of Chief Engineer of Corporation in October

1933 and served the Corporation till 1943 with unique distinction. He was a born nationalist with revolutionary ideas. His first confrontation with the Government took place over installation of a turbo alternator at Tallah as a stand by to the alternator installed at Palmar's bridge pumping station to supply power for running their installed motors and supply electricity to the Hogg Market and Central Municipal Office. The cable linking Tallah to Palmar's bridge had to be laid through a small stretch of land which belonged to the Irrigation Department, Government of Bengal. Permission was sought but it was denied without assigning any reason. Fortunately for the Corporation and unfortunately for the Government a confidential letter written by the then Chief Engineer, P. W. D. to the Secretary, Local Self Government stating that sanction to the proposal has to be denied as otherwise interest of the C.E.S.C. would suffer, was wrongly, despatched to the Corporation of Calcutta. This was flashed in the Dailies of Calcutta on the following morning. On the same night the cable was laid through the Government land without any interference from any quarters. The permission of Government which was sought for—came shortly after that.

Just about that time the Calcutta Electric Supply Corporation which was purely a British organisation was attempting to raise the rates of both high and low tension electricity supplied to the Consumers. The Government set up a Committee to go into the question and Dr. Dey was on the Committee to repres sent the Corporation of Calcutta. Dr. Dey by his forceful argument and facts and figures collected, proved that there was no justification for increasing the electricity rates and thus saved thousands of consumers from additional expenditures on that count. He was the person who moved to take over or nationalise the Tramways Corporation Limited. Government at certain point of time agreed—but then dropped the idea on the ground of financial stringency. After three decades—the present Government is also thinking on the same line.

Dr. Dey took part in all nationalist movements and was held in confidence by all leading Nationnlists of Bengal. He was a great admirer of Netaji and at his request installed a water supply system for the Congress Session held at Ramgarh. He advised many Industrialists in establishing new factories. He was directly connected with the establishment of cement Factory in Chatak now in Bangladesh. He was connected with many Institutions for Technical education. He was the Founder President of the Calcutta Engineering College in south Calcutta which imparted education in Civil, Mechanical and Electrical Engineering to the standard of Diploma in Engineering. Socially he was very pleasant and a wonderful host.

The city of Calcutta during the thirties and early forties was known as the 2nd City in the British Empire. It is a city of vast national importance politically and economically with historic leadership in education and culture. It was the finest and largest sea port in the Eastern India which besides Bengal served Bihar, Orissa, Assam, Tripura, Manipur and the Eastern Districts of Uttar Pradesh. The port even according to 1964 figure cleared 42 per cent of India's Export and receive 25 per cent of India's Import. Physically—the citiy with a large river front, recreational areas, play grounds, several parks, scattered throughout the city was not an unpleasnt spot to live

in though there were large concentration of Bustees—mainly in the eastern fringes of the city.

But violent changes—physical—economical and social started taking place since the early forties.

The river Hooghly started silting at a very rapid rate as the upland water from the Ganges was cut-off for nine months in a year and the volume of water which used to find its way into the Bhagirathi, Hooghly was diverted to the Padma. This crippled the activities of the port and larger ships could not enter the port without being partly unloaded at some point in the down reach of this river. It also affected the supply of water for domestic use due to high salinity between March and June. The filtered water of Calcutta used to be sweet, moderately hard, free from impurities and of very high standard.

Since independence and partition of Bengal apart from normal growth, there was huge influx of population from East Bengal. This unprecedented concentration of population in the City and Suburbs strained the municipal services like water supply, sewage, drainage and disposal of garbage. This completely upset the social structure. Partition also badly hit the economics of the state of India, as Jute which used to be grown in East Bengal and processed in Calcutta Metropoliton District, used to be shipped abroad from Calcutta and was the major Foreign Exchange earner. The quantity of tea produced in East Bengal, which is another Foreign Exchange earner, did not reach Calcutta for shipment. Displaced persons squatted in all available spaces including pavements, station premises, parks, over low lands and even on drainage channels. The environmental sanitation of the city suffered and Calcutta earned the unique distinction of being the foci of endemic cholera in the East Asia. The State Government and the Central Government were seriously concerned about the rehabilitation of the displaced persons and growing unrest due to frustration. The situation was grave. The then Chairman of the World Bank in a beautifully worded note drew the attention of U. N. O. and W. H. O. of the economic and Sanitary condition prevailing in the West Bengal, particularly in Calcutta. Late Dr. B. C. Roy, Chief Minister moved the Central Government, who approach the W. H. O. to send a team of experts to survey the situation and advise on steps that should be taken to improve the environmental condition of the city and its adjacent areas. A team of four experts headed by Dr. Able Wolman Emeritus, Professor of Sanitary Engineering of John Hopkins University, came to Calcutta in 1959. A report was submitted in early 1960 and several important recommendations on policy and administrative matters were made, apart from technical evaluation and recommendations. The main features of recommendation are (1) There should be one single authority responsible for implementation of the project and maintenance of water supply including distribution, sewerage and drainage of the Greater Calcutta. (2) The authority should have the power to tax and charge individual consumers who shall have to pay according to the quantity consumed. (3) They should be able to float loans and raise funds. (4) The area from Kalyani to Budge Budge on the East Bank and from Bansberia to Uluberia shall be the area of operation. (5) Sewerage and Drainage of the area shall designed on the basis of Drainage basin. (6) The matter does not brook any further delay and compre-

hensive Engineering Project planning should be undertaken. (7) Farrakka Barrage project must be taken up and completed as expeditiously as possible, preferably by 1964.

The report was accepted by the State Government and Central Government. The Central Government approached W. H. O. for consultancy service and U. N. D. P. for necessary funds for preparation of the Master Plan for water supply, sewerage and drainage of the C. M. D. which cover 490 Sq. miles and 33 local bodies.

While this was being processed, Late Dr. B. C. Roy, while visiting U. S. A. had an interview with President Kennedy and persuaded the Ford Foundation to send expertise for preparation of a Master Plan for physical, social and economic development of the Calcutta Metropolitan District in collaboration with local planners, engineers, economists etc. The Calcutta Metropolitan Organisation known as C.M.P.O. was established in August 1961 but it really started functioning effectively from March 1962 by which time most of posts of various disciplines were filled. Ford Foundation also sent their technical experts. A Basic Development plan was prepared and submitted to the State Government in 1966. The basic development plan as prepared has four inter-related objectives :

(1) To promote a more dynamic growth of the metropolitan economy with increased production and income with sufficient employment opportunities, and with close integration with the economic development of the region for which Calcutta provides vital economic function. (2) To develop an urban environment which is socially satisfactory and capable with appropriate facilities and services for a population of about 12.5 millions in the C.M.D. by 1986. (3) To create the Machinery for sustained development planning and for effective plan implementations. (4) To strengthen Local Self Government and citizen's participation in the development of Metropolitan district through a more effective mobilisation of fiscal resources, civic leadership and voluntary citizen effort. The basic plan fixed priorities and phased programme of work for the two decades. The highest priority was given to the improvement of environmental sanitation by providing adequate potable water supply throughout the area including non municipal urban areas, and providing facilities for disposal of storm water of the whole area. Collection and disposal of garbage of the City of Calcutta and Howrah also received high priorities.

In the development programme priority was given to Hooghly river crossing, construction of several arterial roads like Eastern Bypass, Barackpore Kalyani Express Way, Kona Express Way and others. Improvement of Bustees or slums by providing water supply, sanitary latrines, common bathing platform, paving the roads and lanes of Bustees and providing street lights, was given the highest priority. Improvement of rapid transit system by improving the existing facilities and also by providing either under ground or overhead transit system was considered essential. The works were phased for short term and long term improvement. For the purpose of implementation of sanitation programme and maintenance of the system, Calcutta Metropolitan Water and Sanitation Authority was created by enactment of an Act. as was envisaged in the Master Plan. This authority though created could not function due to vehement opposition of the local authorities. This

being the situation the whole philosophy of establishment of such a body was defeated as the main object was to make these facilities self supporting by sale of water and a surcharge on the water to meet the maintenance cost of sewerage system to distribute the facilities equitably and to prevent misuse or abuse of the same.

Subsequently C.M.D.A. was established by legislation as a body with wide powers to execute works, co-ordinate the activities of different implementing agencies and evaluate the work done. They are empowered to float loans, distribute the funds accordingly to project estimate without the normal procedure of going through the Finance department, which is a time consuming procedure. In fact this is an autonomous body within the Government and most of the Staff recruited are from different departments of Government. At the latter half of the Third Five Year Plan a sum of Rs. 10 Crores was allotted to the State Government. This was a windfall no doubt but the State Government was in a quandary. They had no organisation, no detailed plans and no materials in stock. The major projects included were emergency water supply for Howrah, Tollygunge and all the Municipal areas and some congested urban complexes within C.M.D., provision of sanitary sewerage in the most congested parts of the city of Howrah and remodelling of some of the existing outfall channels.

As was expected, very little progress could be made due to difficulties experienced in acquisition of land, collection of materials and sufficient number of technical personnel in different organisation entrusted with the work. Only about 50% of the money allotted could be spent and ever then some of the works under taken could not be completed. The objective was to spend as much as possible. At the time of Budget for the 4th Plan, provision was greatly reduced by the Centre on the ground that the performance of the State Government was poor.

During the Fourth Plan upto the end of 1970 very little was achieved as no organisation was aware what would be the future policy, what funds would be made available and who would implement the programme and who would maintain these finished works. The State Government again found themselves in the similar position when during the fag end of the President's Rule in the State, large sums, about Rs. 150 crores were provided at the initiative of Late Mr. B. B. Ghosh, the senior advisor to the Government. There being no unitary organisation, the work was distributed between Calcutta Corporation, Calcutta Improvement Trust, Howrah Improvement Trust, Calcutta Metropolitan Planning Organisation, Calcutta Metropolitan Water & Snitary Authority and Calcutta Metropolitan Development Authority. The C.M.D.A.'s main function however is to co-ordinate and evaluate the work executed by these agencies. We are all very happy to note that things have started moving and major works as per priority given in the Plan are being implemented. Large sums of money have been spent and are being spent, but as mentioned by Mr. Kidwai the Chairman of the Evaluation Committee that C.M.D.A. will not be able to reach the target because of difficulties in acqisition of land and scarcity of basis materials like steel, cement, stone chips, bricks, etc. These are not new factors unknown to the authorities. In their anxiety to spend the allotted sums of money large number of

projects have been taken up resulting in phenomenal rise of prices of all constructional materials. In my view resource planning of men and material should be made and works to the extent material is available should be taken up. Every effort should be made to increase production of building materials.

There should be arrangement for in-service training of technical personnel by senior departmental Staff, who are recruited for such works. This is a healthy practice followed in many progressive Countries.

Many projects undertaken in 1958 have not been completed and pumping machinery which were received in 1966 or '67 have not been taken off packing box yet. Roads opened for laying water main or storm sewers have not been restored. There may be cogent reasons, for such delays, but the common man attributes this to inefficiency and callousness of the persons concurned. It is also said that many deviations are being made specially regarding storm flow sewers which are to discharge either in the river Hooghly or Tolly's Nallha. In the master plan great emphasis has been laid in the matter of discharge of storm water into the river Hooghly. Such discharge shall not be mixed with sewage or industrial effluent as the river will have in-take stations at Garden Reach and on the opposite bank for supply of domestic water. The river water must on no account be polluted as the river is already being polluted with discharge of effluents from paper mills and others toxic liquid wastes. It is therefore essential that there should be unitary authority which will implement the programme in all respects.

As I believe most of us assembled here are Engineers. I do not think it would be out of place to remind ourselves what an Engineer and Planner should be. He should have ability to observe, deduce, apply and co-relate cause and effect, to co-operate, to organise and to direct efforts of others. "Qualifications of such professional men should include morality, honesty, courage, independence, resource-fulness, ingenuity, orderliness, accuracy and endurance. He should have a large vision, the boldness to conceive and execute and more than all, a keen urge to better the lot of his fellow being."

With these I would request you pay homage with me to a great Engineer Dr. B. N. Dey who fulfilled the qualifications stated above.

Hon'ble Minister Sri Bholanath Sen delivering the Chief Guest's Address.

I S E ANNUAL SOCIAL 1973

Sri P. C. Bose delivering the Dr. B. N. Dey, Fourth Memorial Lecture.

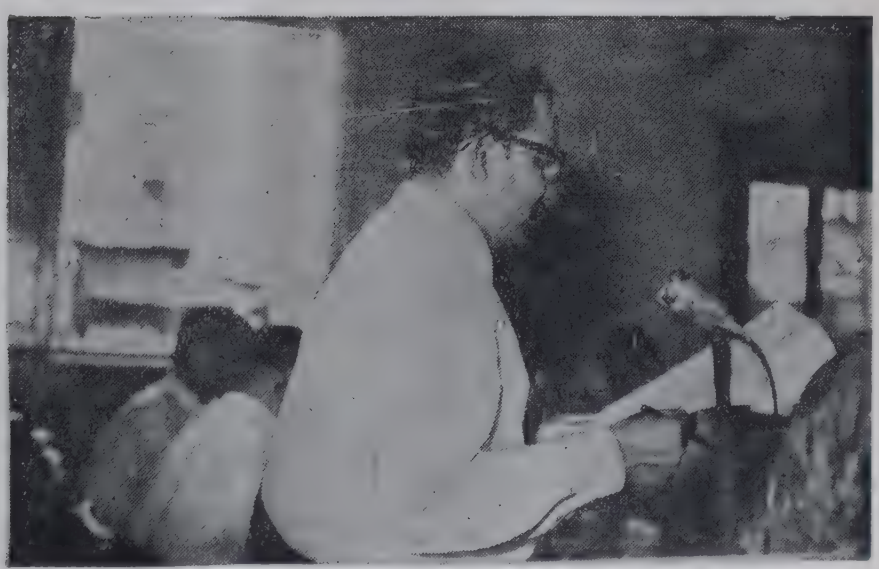
Sri P. C. Mitra addressing the house.

I S E ANNUAL SOCIAL 1973

A General view of the house.

Sri U. P. Mullick delivering the Presidential Address.

I S E ANNUAL SOCIAL 1973



Sri R. N. Dutt presenting the General Secretary's Report.

Diploma Handing - Over Ceremony

Invited by the President, Hon'ble Sri Bholanath Sen, the Chief Guest, handed over the Diplomas of Honorary Fellowship and Fellowship to the recipients. Sri Raj Krishna Banerjea, Vice-President read out the relative Citations.

Sri P. C. Bose receiving the Honorary Fellowship Diploma.

I S E ANNUAL SOCIAL 1973

Sri U. P. Mullick receiving the Honorary Fellowship Diploma.

Diploma Handing - Over Ceremony

Sri Sukumar Bhattacharyya, receiving the Diploma of Fellowship from the Hon'ble Minister.

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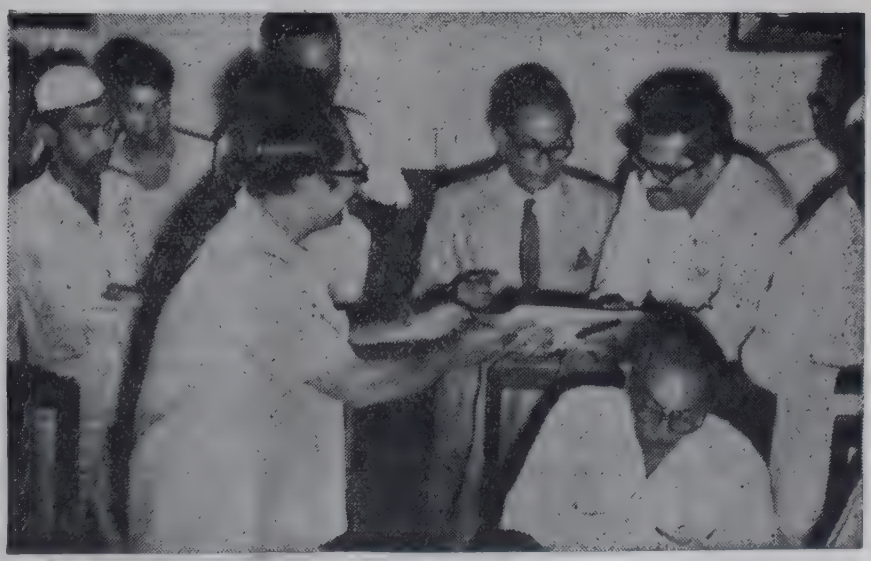

Sri G. L. Sinha, receiving the Diploma of Fellowship on behalf of his father, Sri M. L. Sinha in absentia. Sri Banerjea is seen standing behind at the centre.

Diploma Handing - Over Ceremony

Sri S. R. Paul, Manager, Late Sri L. P. Molnar's Mining & Engineering Pvt. Ltd., receiving the Diploma of Fellowship posthumously on his behalf.

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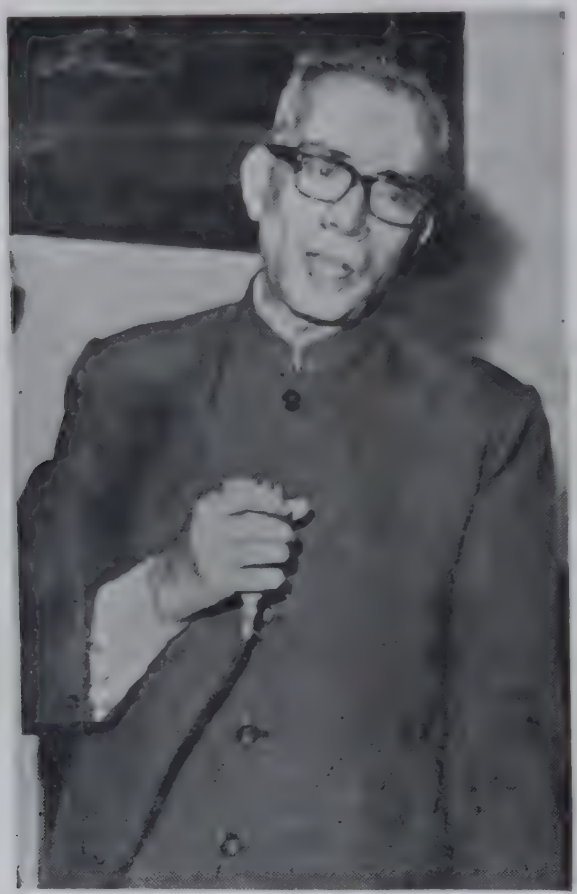

Thanks-Giving by Sri I. B. Ghosh, Vice-President.

SRI P. C. MITRA'S ADDRESS

Text of Speech delivered by Shri P. C. Mitra, Chairman, Calcutta Port Commissioners, at the I S E Annual Social on August 4, 1973.

Mr. President, Ladies and Gentlemen,

I am very much pleased and greatful that I have been asked to say something at the Dr. B. N. Dey Memorial Lecture. For a long time I had been associated with Dr. Dey and had many discussions after coming back from my training in U. K. I have fully appreciated the sentiments expressed by Shri P. C. Bose about the great Engineer, Dr. B. N. Dey. Dr. Bose has given very interesting details about this great Engineer in such a manner that we can learn the history of this State for nearly 50 years.

Mr. Bose has very correctly mentioned that the interest of the Port of Calcutta is not properly and adequately looked into. Unfortunately, Farrakka Barrage has not yet been completed resulting in a tremendous and adverse effect in the scheme. Mr. Bose is very right in his observation that unless the river Hooghly is put free from siltation by additional inflow of water, the economy of the conntry must encounter a severe jolt as a full year operation of the Port cannot be compensated between the period from March to September only. We are doing our best to keep the Port functioning throughout the year. The dredging operation is going on throughout the whole year to keep the river navigable. We have got several types of Suction Dredgers for this purpose. Mr. Bose is very right in saying that the economy of the country mainly depends upon her navigational facilities. This hurdle may be overcome after the completion of the Farrakka Barrage when we will get the required quantity of water for the smooth functioning of the Port and so we are looking forward to the early completion of the Farrakka Barrage.

Alternatively, we have constructed a satellite Port at Haldia. The Oil Jetty is functioning for the last few years. Last year we accommodated as many as 80 ships. An Oil Refinery is under construction at Haldia and it is expected to be completed in the early part of the year 1974 and a docking system latest by October, 1974.

Calcutta Port will be the main zone, the heart of eastern navigational traffic for time to come If Farrakka water is made available, there will be no difficulty in accommodating large ships all through the year.

Once again I am thanking you all for inviting me and the honour and appreciation awarded to me with deep admiration.

GENERAL SECRETARY'S REPORT

presented by SHRI R. N. DUTT, to the 39th Annual General Meeting of the India Society of Engineers held at Broadway Hotel, Calcutta, on Saturday August 4, 1973.

Our President and Friends :

A year is going round since we met at the last Annual General Meeting of the General Body of our Society on August 26 and September 27, 1972 on the floor of the office of the Society.

In this re-union, with a heavy heart, I have got to report to you, that we are very much missing the delightful presence of that ever-smiling personality, our beloved Vice-President Shri L. P. Molnar who passed away on Saturday July 21 last. A Hungarian Engineer migrating to India before Independence, Shri Molnar joined our India Society of Engineers as a Member in April 1947, becoming a Fellow in July 1971. He was elected a Vice-President of the Society following the 1971 Annual General Meeting in August that year and had been continuing in this office on re-election thereafter. He was expected to continue in the next Executive Committee to be constituted on this floor but sudden death has bereft us all of his valuable counsel any further. May his Soul rest in peace.

The 31 - Member Executive Committee, which was constituted at the last Annual General Meeting, took office on October 27, 1972, under the Presidentship of our veteran guide Shri U. P. Mullick on re-election and with a new General Secretary in Shri A. W. Lalwaney who succeeded another Old Stalwart Shri Raj Krishna Banerjea remaining in office for four years. Shri Lalwaney, however, had to resign in seven months due to his transfer in service from Calcutta to Poona and the responsibility came down on to my humbleself from May last.

Our Programmes & Departments.

The following Departments and Committees were appointed with the respective members, to execute the different programmes of activities as cited below, under general supervision of the President and General Secretary.

Development Department :

Advisors—Shri R. K. Banerjea, Shri S. Bhattacharji.

Convenor—Shri S. K. Ghosh, Assistant Advisor.

Terms of Reference :

(a) Home Administration under charge of Shri R. K. Banerjea.

(b) Under charge of Shri S. Bhattacharji.

(i) Furthering the interest of the Society in various States and also abroad.

(ii) Classification of members category, and State-wise.

Finance Department :

Advisor—Shri I. B. Ghosh ;

Secretary—Shri R. N. Dutt.

Terms of Reference :

Accounts and Audit of Society funds.

Publicity & Public Relations Department :

Advisor—Lt. Cdr. B. Mukherjee ;

Secretary—Shri G. L. Sinha.

Terms of Reference :

(i) Organising visits to factories and places of interest.

(ii) Organising Symposium, Lectures, Meetings and Social Gatherings etc.

(iii) Liaison work with sister organisations in India and abroad.

(iv) Promotion of Publicity of the Society.

Library Committee :

Advisor—Shri S. M. Sarkar ;

Secretary—Shri B. N. Ghosh.

Terms of Reference :

Cataloguing and publication of the Lists of Books and improvement of the Library.

Editorial Board :

Chairman : Shri U. P. Mullick ;

Shri L. P. Molnar ;

Shri B. N. Rakshit ;

Shri Sukumar Bhattacharyya ;

Shri Raj Krishna Banerjea ;

Lt. Cdr. B. Mukherjee ;

Shri A. W. Lalwaney ;

Shri Shantonu Paul (on co-option).

Editor : Shri G. M. Bhattacharyya ;
Commercial Secretary : Shri G. L. Sinha.

Terms of Reference :

Guiding Editorial and General Policy of the Society Journal and looking after its publication, general improvement and finance.

Brain Trust :

Under the care of President—
Shri U. P. Mullick ;

Vice-President—Shri L. P. Molnar ;

Convenor— Shri B. Singh.

Terms of Reference :

Improvement of Technical matters relating to import substitution and Engineering policies.

Technical Department :

Advisors : Shri B. N. Rakshit ;
Shri B. N. Roy Chowdhury.
Convenor : Shri R. N. Dutt.

Terms of Reference :

Examinations and Technical matters and Technical services to members.

Development Departments Activities.

Membership :

The first point of concern in a progress report on the Working of Societies like ours is the extent of growth in the organisational structure which is reflexive of the gains in registering support of the general body of engineering and technical personnel, secured in favour of the Society. Our progress during 1972 regrettably, has not been much enough, rather almost as slow as during 1971.

In the following table will be found a comparative picture of our membership pool at different categories during the last five years, as also of the up-to-date position and the total strength :

	(Up to 1967)	1968.	1969.	1970.	1971.	1972.	(Up to July 1973).	Total.
Fellows	—	—	—	2	4	2	—	8
Members	554	13	14	20	28	16	15	660
Associate Members	1,875	62	46	66	59	73	65	2,246
Licentiates	384	25	18	18	14	6	3	468
Associates	47	4	9	7	4	4	—	75
Graduates	100	2	10	4	2	1	2	121
Students	122	1	—	1	—	—	—	124
Total.	3,082	107	97	118	111	102	85	3,702

Classified Registry :

Now that we have been able to register the affiliation of a good number of the technical personnel, the Executive Committee has lately thought of compilation of a Classified Registry of the Members according to the branch of professional specialisation of a member like Civil, Electrical, Mechanical and so on, whereby the Society should be able to provide a growing pool of the technical talents and know-how in the different engineering and technological disciplines at the disposal of the nation. The classification work is already on and members who have not yet sent are requested to send soon their latest bio-data with line of specialisation to the office of the Society for the purpose.

State-wise, as also city-wise classification has also been taken on hand. Members are requested to co-operate with the office in the matter, by intimation of their latest postal address in full.

Publicity & Public Relations Departments Activities.

Local Chapters :

During recent years, it is being seen that members away from Calcutta have been feeling for the need for a local unit—so that a community life could be created among the brother-members in different places of their respective employment or occupation. This is a very healthy sign indeed and would additionally provide an opportunity of inter-twinning a brotherhood with the technical population in an area still remaining outside our Society.

Our South India Centre in Coimbatore founded in 1949 had a rejuvination with the visit

of our President Shir Mullick in February 1972 as a Guest of the Centre's, Founder Chairman Shri G. D. Naidu who arranged for a Get-Together of the members there on the occasion.

As a sequel to this, some brother members in Madras—Shri S. Gurunathan, Shri S. Thiagarajan and Shri N. Viswanathan—felt inspired to initiate a Madras Chapter and, you will be pleased to know, its initial office has just been set up.

Brother members in Bombay too like Shri M. Mohon and Shri M. G. Garg have expressed their willingness to work for a City Chapter being set up there. Lists of Members there have been compiled and forwarded to them for the purpose.

Also our Public Relations Advisor Lt. Cdr. B. Mukherjee is in correspondence with the members in Durgapur for a local unit being set up there. Response received from the members is encouraging.

Friends Abroad and Brain-Gain :

Our brother members abroad too are no less enthusiastic in rendering service to the Society from there. Among those special mention should be made of the interest being taken by Shri H.C. Chatterjee, Chief Electrical Engineer, Vinokur Pace Engineering Services Inc. of Philadelphia, U.S.A. He was appointed in late 1970, as already announced to you, the Honorary Corresponding Member in the U. S. A. His recent activities for the society include registering members from there and raising a Building Fund for the Society's Central Office here. Shri Chatterjee is perhaps well known to you all through the medium of our Journal "Science & Engineering" for which he often writes on different topics of his study and know-how.

Two other member-writers for the Society Journal worthy of mention in this context are Shri D. K. Das of Hamburg, West Germany, and Shri A. Choudhury of Pipelines Projects (R. & D.), Canadian National Railways at Montreal.

From their working association with the Society, we may proudly say that we are doing our mite in contributing to a Brain-Gain, to whatever little extent or form it might be, against increasing Brain-Drain from the country.

We have no fewer members in those and other countries abroad—both nationals of India and non-nationals.

A developing country as our India is, with the Fifth 5-year Plan before her and having the willingness to share experiences of—also with—other nations in technological fields, we think, we shall be doing a national service by harnessing the talents and enthusiasm of brother members abroad to provide a channel of Brain-Gain for the country—be it in the form of additions to our membership from abroad or of write-ups on developments abroad from which India's engineers and technicians will wish to profit.

Brain-Trust Activities.

Late Shri L. P. Molnar, Vice-President of the Society's Brain-Trust contributed during the year certain very important articles on import substitution of plants and machinery for steel, coal and other mineral industries, which he did in furtherance of the Brain-Trusts' Import substitution efforts. The Society's series of Editorials during the year run by President Shri U. P. Mullick well covered in the engineering policies of the Brain-Trust.

Editorial Board's Activities.

Our Journal :

Our Journal "Science & Engineering" as the continuation of the Journal of the 'India Society of Engineers' you will be pleased to know has completed 38 years of existence, in June this year. For all these long years it has been doing its best, as far as it could, in performing as a technological intelligence service for the profession and nation alike. Unfortunately, however, paucity of funds available has often stood as a formidable hurdle on its runway. During 1972, as you must have noticed, only five issues could be broughtout. The Journal Committee, i. e., the Editorial Board appointed by the present Executive Committee, was therefore obliged to economise space for each individual issue of the Journal from January this year. The line of production with 12-Page text in each issue since has been going on somehow, but, a break occurred with abrupt suspension of work by the printers when the May issue was to be in print. New printers have been appointed and lawful permit in this respect obtained. June issue has appeared. Future ones are hoped to be out according to schedule.

The difficulty in finding finance for the Journal obliged the Executive Committee to adopt, at its meeting on December 15, 1972, a Resolution to the effect that "Every Fellow and Member will be required to pay a Special Annual Fee of Rs. 20, Associate Member Rs. 15, and Licentiate and all other non-Corporate Members Rs. 10, failing which he will cease to receive copies of the Society Journal or enjoy Library Service and other benefits'. Response from members has not been meagre but the larger community of them are yet to send in their helpful contribution, who are being requested to stand by our drive to build, thus, a working fund not only for the Journal but also for other necessary services like seminars, paper-meets, etc., besides enrichment, of the Society Library.

Finance Department Activities.

Fund and Finance :

Bereft of Governmental or any other external financial support, our funds naturally have to depend on the revenues drawn mainly from the Membership Fees. Receipts on Journal account by way of subscription or Special Annual Fees happen to augment the resources to some extent. The working of our finance during the year ending 31st. December 1972 against 1971 will be found in the Audited Statement of Accounts and Balance Sheet for the year before you. How poorly we rand on all scores, is evident. No wonder, all services due and demanded of us are staring despite all pious wishful thinkings as conceived in the programme of activities set-forth under different Departments already mentioned to you.

When finance is the only key to development, it is important that all members should decide to stand by the management—with what they can do without much ado—by ;

i) depositing Membership Fees in time without a reminder from office being required ;

ii) paying respective Special Annual Fees regularly ;

iii) introducing new members into the Society ;

iv) introducing subscribers for the Society Journal ;

v) Securing advertisement support for the Journal from firms and establishments owned or known.

Library Committees Activities.

Library :

Another request to the members is that they may please see if they can donate one or two books to the Library of the Society, which very much requires to be expanded and equipped with current additions is starving due to non-availability of funds. Our stocks mainly are of old, rather out-dated volumes. A recent stock-taking has revealed that a substantial part of these have either been lost or soiled and are un-recoverable. However cataloguing of available stocks is on hand and efforts are being made to make the Library more useful to the members.

It, of course, is to be added that our Library has in stock some very valuable books and volumes of reference besides regular supply of several important technical periodicals. Some such foreign Journals are in Japanese, Chinese, German, Russian and other East European Languages. The Society's office-hours have been so fixed that members in Calcutta may avail of Library benefits after their usual working hours. Their visits after office for the purpose and living association with the Society are welcome, and it is hoped the members will make the maximum utilisation of the Library facilities available.

World Congress in Israel.

Although we ourselves have grievously failed to sponsor Seminars or Congresses, we often receive invitation to such function here and abroad. The latest invitation received by us from the sponsors of such an International get-together concerns the 3rd World Congress of Engineers & Architects at Tel-Aviv, December, 1973. Re-affirming the invitation, the President of the sponsoring body, the Association of Engineers & Architects in Israel in his latest communication dated July 5, 1973 writes. "It is my pleasure to confirm herewith that two delegates of your Society will be very welcome guests at the forthcoming event, and their local expenses in Israel during the Congress period—hotel accommodation and board, pre—and post-Congress tours—will be on our account. No Registration Fees will be required from your delegates. The Tel-Aviv Congress and the invitation to us was published in the "Science & Engineering" for January last. In response, Shri A. P. Singh of Howrah has expressed his willingness to be a delegate at his own travel and incidental expenses. Another likely delegate is Shri Shantonu Paul of Hindustan Export & Import Corporation in Calcutta. A Paper titled "The Art of Modelling in Hydrology" contributed by Prof. George Alexander, Head of Civil Engineering Annamalai University and by Prof. K. Achuthan, Reader in his Department, has been forwarded to the sponsors for being read at the Congress.

The J. I. E. C. & Brain Bank.

I need remind you that our Society happens to be one of the sponsors of the Federation of Professional Engineering Institutions in India having for its Chairman our President Shri Mullick and our Shri Raj Krishna Banerjea as its Secretary-General. The Society also provides its Secretariat to function in its own office. The FPEII is also a struggling body as yet. It at the moment has on hand a plan for assessing the resources of the different

institutions in the country in respect of manpower and know-how pool at their respective disposal. This survey, when done, will be a valuable inventory of available Consultancy Services and, so to say, a Brain Bank in the different fields of engineering and technological disciplines which the Government of the country could be able to draw upon for execution of the Five-Year Plan in general, and specially for Metropolitan and Rural Development programmes.

Conclusion

Our President and Friends, I have now done but before concluding I must thank Shri Mullick and other members of the Executive Committee for the pains they have been taking in administering the affairs of the Society.

I must also thank our new Auditor appointed for the year, Shri A. G. Banerjee, for the services rendered in care-taking and auditing our Accounts for the year for a small fee.

My thanks also are to the members of the office-staff for the excellent loyalty and devotion to work they have exhibited. You will be pleased to know that very recently some increment in their salaries has been provided for. Also recently the Employees' Service & Leave Rules have been framed and adopted.

Lastly, I thank you all for the kind and patient hearing paid to me.

THE I. S. E. EXECUTIVE COMMITTEE

As costituted at the 39th Annual General Meeting held in Calcutta on August 4, 1973

On Election at Annual General Meeting :

Prof. G. M. Mandalia, M.I.S.E.
Department of Architecture.
University of Roorkee, (U. P.)

Shri B. Singh, M.I.S.E.
Managing Director, Beni Ltd.,
1, Crooked Lane, Calcutta-1.

Shri Sudhin Bhattacharji, M.I.S.E.
93-B, Kankulia Road, Calcutta-19

Lt. Cdr. B. N. Mukherjee, I.N. (R) M.I.S.E.
M/s. Mahabir Marine Traders,
29, Waterloo Street, Calcutta-1.

Shri A. W. Lalwaney, M.I.S.E.
Deputy Manager, High Explossive,
Factory,
Roorkee, Poona-3.

Shri G. L. Sinha, M.I.S.E.
Proprietor, Midland Electric Co.
34, Ezra Street, Calcutta-1.

Shri Shri B. N. Ghosh, A.M.I.S.E.
22, Talpukur Road, Calcutta-10

Shri S. K. Mohanty, M.I.S.E.
Asstt. Chief Inspector (Metals),
Bhilai Steel Plant,
Qts. No. 3/21/IX, Bhilai (West), M.P.

Prof. F. V. Albin, M. I. S. E.
Ph.D, Scholar in Refrigeration &
Air Conditioning,
Department of Mechanical Engineering,
Indian Institute of Technology, Madras-36,

Shri M. Kuppuswamy, M.I.S.E.
Superintending Engineer, Ministry of
Food, Agriculture, Community
Development Corpn.,
'Krishi Bhavan', New Delhi.

Shri P. C. Roy, A.M.I.S.E.
Engineer, Atlas Cycle Co. (P) Ltd.
30-R, Model Town, Sonepat (Haryana).

Shri K. R. Narayana Rao, F.I.S.E.
359, 1st Block, 7th Cross,
Jayanagar, Bangalore-11.

Shri M. K. Thakur, F.I.S.E.
Architect & Valuer,
1, 2, Rasrajeshwar Pritamari Road,
Ahmedabad-6 (Gujarat).

Shri G. M. Bhattacharya, M.I.S.E.
Manager, Industrial Engineer,
Machinery Manufacturers Corpn. Ltd.
79/18/2, Lower Circular Road,
Calcutta-14

Shri N. Viswanathan, M.I.S.E.
Civil Engineer, Sundaram Clayton Ltd.,
7, Single Person's Quarters,
Mount Road, Nandanam, Madras-35.

Shri K. P. Tiwari, M.I.S.E.
Addl. Construction Supdt.,
Fertilizer Corporation of India Ltd.,
P. O. Godavarikhani, Distt. Karimnagar,
(A. P.).

Shri P. M. Chauhan, M.I.S.E.,
Engineer,
P, O. Katras Road, Distt. Dhanbad,
(Bihar).

Shri V. P. Bhise, M.I.S.E.,
Chemical Engineer,
E-22, Hindusthan Antibiotics Colony,
Pimpri, Poona-18.

Shri V. R. Kuloor, A.M.I.S.E.
Engineer & Surveyor,
54, Sree Niwas Raghavachari Street,
R.S. Puram, Coimbatore-2 (Tamilnadu).

Dr. M. N. Sarkar, M.I.S.E.
Development Manager,
Mechanical Engineering Division,
Bird & Co. (P) Ltd.
Dakhindari, Calcutta-48

Shri Madan Mohan, M.I.S.E.
Consulting Engineer,
D/104, Simla House, Hyderabad Estate,
Nepeansea Road, Bombay-20

Shri B. B. Joshi, M.I.S.E.
Incorporated Engineer & Registered Architect,
146, Opp. Gole Bagh,
Amritsar (Punjab).

Shri S. Saratchandran, M.I.S.E.
Chief Engineer,
Hindustan Development Corporation Ltd.
Res : 16/1, Deodar Street, Calcutta-19

Shri S. C. Das Gupta, M.I.S.E.
Officer Inchage, Plant Central Garage,
Head Equipment Section,
C-2/11, T. C. Bose Avenue, Durgapur-5.

As Founder Secretary :

Shri B. N. Roy Choudhury, M.I.S.E.
83, Ballygunge Place, Calcutta-19

As Outgoing President :

Shri U. P. Mullick, F.I.S.E. (Hon).
Consulting Engineer & Architect,
M/s. Hope Johnstone & Sons,
9, Hastings Street, Calcutta-1

As Outgoing General Secretary :

Shri R. N. Dutt, M.I.S.E.
186, Baghmari Road, Calcutta-11

On Nomination by Outgoing President :

Shri Raj Krishna Banerjea, M.I.S.E.
10/A, Sahitya Parishad Street,
Calcutta-6

On Nomination by Outgoing General Secretary :

Shri S. M. Sarkar, M.I.S.E.,
17, Beniatola Lane, (Top Floor),
Calcutta-9

On Nomination by Outgoing Executive Committee :

Shri G. D. Naidu, F.I.S.E.
'Gopal Bagh', Avanashi Road,
Coimbatore-18

Shri N. Chowdhuri, F.I.S.E. (Hon).
B-7/132, 9th Street,
Kalyani (Nadia), West Bengal.

Shri I. B. Ghosh, M.I.S.E.
C-5, 'Bharat Bhavan',
3, Chittaranjan Avenue, Calcutta-13

Shri B. N. Rakshit, M.I.S.E.
Electrical Inspector, Government of W.B.,
1, Harish Mukherjee Road, Calcutta-20

Shri S. Bhattacharyya, F.I.S.E.
Architect, Howrah Improvement Trust,
53, Suburban School Road, Calcutta-25

Shri S. K. Ghosh, M.I.S.E.
65-A, Kankulia Road,
Calcutta-19

SCIENCE & ENGINEERING

JOURNAL OF INDIA SOCIETY OF ENGINEERS

VOLUME XXVI
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SCIENCE & ENGINEERING

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SCIENCE & ENGINEERING, now published every month, is the continuation of the JOURNAL OF INDIA SOCIETY OF ENGINEERS, completing its 38 years of publication in June 1973, it is principally devoted to dissemination of the news of current development in the art and science of engineering and technology.

Popular contributions on scientific, technological, engineering industries and other allied subjects are invited for publication .

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SCIENCE & ENGINEERING

Volume XXVI. No. 7 August 1973

TWENTY SEVENTH YEAR OF INDEPENDENCE

The twenty-seventh year of India's Independence sees her in the midst of various dilemmas. She has not been able to walk along any rosy path to success. Her First, Second, Third and Fourth Five-Year plans have no doubt made some successful attempts in the sphere of industrial development and development of agriculture. Nevertheless she has more problems at the end of the twenty-seventh year than she has solved.

When we look back in retrospect we find that the scientific policy of the country was so laid that Science, Industry, Technical Education and Research could go hand in hand with development of industry and agriculture. Nevertheless, hopes have not materialised. After spending 411,500 Crores of rupees during the five full plan periods and two annual plans, the problems before us are still as intricate as before, and we are still far off from the 'take off' stage.

In the agricultural front, though we had some spectacular success in the wheat production in the Punjab area, nevertheless, in the field of other food crops and cash crops, the success has not been as defined. In fact our performance has been poor. Our research in the other crops has not added enough to the production or quality. We have yet to achieve a green revolution in production of rice, a staple food for the Eastern, Northern and Southern regions. Our irrigation system is insufficient. For this reason our food production still depends on the vagaries of the weather, on a good monsoon and good rain fall. Production of fertilisers is far below target and imports of fertilisers are a heavy drain in our foreign exchange resources. Yet with all that the agricultural production is far from satisfactory. The acute shortage of rice is a pointer to this state of things.

On industrial front, our heavy industries which have been set up at immense cost to the tax payer, and though spectacular looking, like our steel and heavy machine building and heavy electrical plants, are not yielding any worth-while profit, and the losses are a drain to the country's meagre finances. In the field of medium industries our performances are scattered and though mostly set up with foreign technology, are not sufficient. In the field of small scale industries, our performance has been extremely poor.

All these are disturbing. particularly our performance in the small scale industry sector. It is known that the largest amount of our industrial income and production come from the small scale industries. The poor performance in this sector means that rise in our national income is being seriously impeded, and production of national wealth is insufficient.

In respect of our mineral resources, so long the intake by our industries have been insufficient, and we had to export most of our valuable ores production to foreign countries. This has resulted in giving a fill-up to foreign producers to offer in our home market finished products in competition against ours, and necessitating severe import control ; our exportable home products being mostly based on high production cost and inferior quality, we are still handicapped in capturing foreign market and competing with foreign production.

Admitting that every attempt is being made to increase our country's export, including export of technology and technical services, not much headway has been made, when we compare the performance of the leading Western Countries and of Japan. While therefore attempts are being made for import substitutions to save foreign exchange, there is a long leeway to make-up.

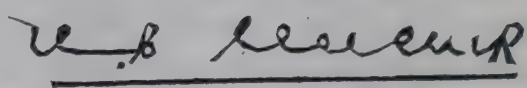
Now when we think of all these, one thing comes to mind uppermost. It is that the crux of the problem with us, as with many under developed countries is the problem of insufficient production and high price rise. The spiral of price rise is eating up heavily our capital investments and making a heavy dent into the national production effort. A direct result of this is that with rising plan investments, the plan performances have been insufficient and poor, and the average people find it hard to meet two ends in their daily life.

To this state of things has to be added the immediate problem of heavy un-empolyment. In fact this is the crux of the problem. It is linked with the countrys' national production. Insufficient production and insufficient industrial development are giving rise to un-employment. Inspite of control of population growths, scope for employment is not expanding at commensurate rate. In this respect our

educational policy is also faulty. It does not make one sufficiently labour oriented, or industry and agriculture minded, or venture some. 90 percent of our young graduates are simply in for services, mostly in administrative services, wanting to find an easy permanent solution to their family life, but at time making the solution of the country's problems at the same difficult.

Our performance in the sector of transports and transport equipments and power have been equally poor after these last 27 years of planning. The poor infrastructure facilities make their contributions to price rise due to difficulty in transport and distribution.

All these are factors which require deep thinking for a solution of the countrys' problems. Simply spending Rupees Fifty-one thousand Crores during Fifth-Plan, and we do not know wherefrom the country will secure such a large finance unless by reckless deficit financing, will not give the desired results nor give any real rise in earning and saving. This in its turn will cause further heavy spiral up of prices, further drain into our capital investments, further strikes and lock-outs and so on. What is probably required is national thinking, a correct appraisal of our resources and ability for performance and rigid control on performance. Political flamboyancy should give place to solid down to earth planning, to give the required performance. Then only the country's people can expect to get relief from their present predicaments.



CLASSIFIED REGISTRY OF I S E MEMBERS

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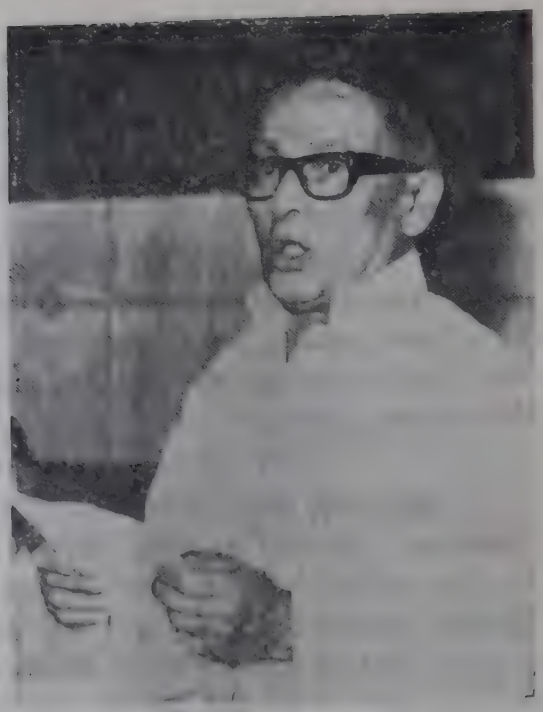
WILL & WAY TO SMALL INDUSTRIES*



By—
Sudhin Bhattacherji, M. A. E., M. I. S. E.

Creation of small industries is a sure way to provide us with mass employment. Mass employment again will improve the economic condition of the country by turn. Knowledge of Science and Engineering will enable us to develop industries.

Science is a special knowledge gained through constant research and experiment leading to an useful operational practice known as industry, through a regulated process known as engineering. So science engineering and industry are closely linked together.

Man was born with brain and rationalism. The rationalism in man made him dig deep for the hidden treasure of nature. His inquisitiveness made her open the doors of her mystery chambers, gradually revealing the secret wealth contained therein, to her dear obstinate children as a reward. So this was the begining of civlisation and start of scientific research in those primitive days. Thus the deliver of soil stepped into the path of science and engineering with a non-stop march upto the present and still marching forward to reach the unknown destination through the unlimited path. Inquisitiveness, Intuition, Necessity and Desire for an easement of existence made his mind restless and kept him on and on to his unlimited and constant search, finally arriving at the present Space-Age.

So far so good ; now we have to wait for further surprises to appear in future. This is the process of survival of the fittest.

Leaving aside the question of the past achievement, I propose to act in the present and look into the future with a desire to secure a prominent place in the committee of nations with due honour.

* Paper read at the Annual Social on the occasion of the 39th Annual General Meeting of ISE held on August 4, 1973. Inability to include this in the Special Number of SCIENCE & ENGINEERING dated July 1973 containing the Proceedings of the same functions, due to space and publication time factors, is regretted.

Editor

So long we have had practically no chance whatsoever to show ourselves as independent industrialists with exception as a few lucky ones under foreign government, who came out in the lime light after struggling hard for their existence. Some eminent scientists made their name and history in foreign lands and became prominent only as teachers and doctors under service. Full advantage of their hard work of research were enjoyed by others. It can not of course be denied that our education in general and also in science and industry including other valuable subjects such as law and medicine etc., came as a gift from our rulers to serve their purpose at the end and for their own benefit and profitab'e advantage. The natural adoptibility of the people of our country into new trade surprised them so much that they started to utilise the services of our people after training them as skilled mechanics and industrial helps as cheap labour only as the services of their own experts were very costly and not easily available.

The so called educated local people from the higher class were employed in their offices as clerks and the like and were nick named as 'Baboos'. These Baboos grew a false sense of respectability and prestige against the labour class or dirty mechanics who were kept in the lowest section of the society. The uneducated labour class had therefore no encouragement from their own people, the Indian Gentlemen. This undoubtedly was a suicidal policy to follow and retarded the advancement of the nation into better field of Science and Engineering. The field of industry was practically a prohibited zone for us to enter into.

Now a new chapter has opened for us. The dawn of freedom has cast it's light on us and we have now developed athe sense of thinking and acting by th scorrect way, the bondage of class and cas gradually disappearing due to critical te economic reasons. We have now a chance of development of our industries as a free nation and we have ample resources and raw materials for our use. This chance we prayed for a long time in the past and should not be missed if we want to stand on our own legs and on the same platform with other advance nations of the world.

At present we have no dearth of technical experts or scientists of high calibre in our country and there is arrangement to train more according to our demand and progress but the question of finance or working capital comes uppermost. We have been left in Chaos, Misery and Want by our foreign rulers, who collected carefully all the valuables as a matter of their policy from this land to enhance their own prosperity at home and pumped us bone-dry before leaving us for good. This is an old story and not forgotten by the sons of the soil. We are now nothing now but glorified beggars ; but instead of crying for the spilt milk of the past, let us pull our socks and tighten our belts to start our life afresh, to act, to act in the living present, to organise ourselves with fresh energy and full of active life.

Let us cut of all the luxuries of life and return to the simple way of living and develop power of high thinking. I remember a writing on the wall of the Y.M.C.A., Gower Street, London by our great poet Sri.Rabindra Nath Tagore which read as follows :

"BE NOT ASHAMED MY BROTHERS TO STAND BEFORE THE PROUD AND THE POWERFUL WITH YOUR WHITE ROBE OF SIMPLENESS, KNOW WHAT IS HUGE IS NOT GREAT.....

By cutting off the fabulous expenses of all our useless luxuries and extravaganza of social ceremonies and pseudo religious performances and wasteful celebrations we sure may save ample money and start our own small industries by Co-operative system in every, locality to employ the local people near their home. The contributor's money will be employed for a real good cause and accumulate every year assuming a good sized capital to earn some substantial amount of divident for the rainy days. Idle brain is devil's workshop the saying goes—let us make every one active and solvent to keep them away from the act of destruction while they are left as Idlers or Devils. Wastage with a capital 'W' should be prevented by all means. The wasters will be transformed into a happy band and become the salt of the soil.

Our Government, a peoples Government, has given us opportunity to borrow money from the nationalised Banks and other sources for the efficient organisation of various small industries. National Small Industries Corporation is one of such organisations who are working very efficiently to help the unemployed, but they are facing with difficulties such as youngmen coming to borrow money without having any scheme of their own or without any idea of practical operation or management, neither have they gone through any practical training, their idea is almost vague. In such cases it is very difficult for the management to allot any loan from the public coffer.

We, who have honest intention of starting any industry must be able to prove our capacity by production of schemes, plans and estimate prepared with practical experience derived through solid training under a competent organisation. Otherwise the loan given from the public fund will be a total loss, the saying goes that—First deserve then desire. The aforesaid corporation not only arranges for loan but also helps with supply of machinery, raw materials and arrangement for sale of the products.

Finance in modern times follows a scientific system of operation and follows the strict rules laid by the economic advisory committees. The Banks, Insurance organisations and other such finance operators act as the custodians of the people's money and they are entirely responsible to the people for it's liquidation or safe custody. It is therefore imperative that genuine cases should only be placed before the financing authority for proper screening, scrutiny and passing for sanction, after proper investigation by the authority concerned.

Industries though well planned and be managed by experts with extreme caution may suffer casualties as well due to calamities and hazards unforeseen. There may be causes such as—FIRE, RIOT & COMMOTION, BURGLARY, THEFT OR DACOITY, MARINE LOSS on land, air and water, DISHONESTY, DEFALCATION, LOSS OF MONEY FROM THE CASH OR TRANSIT, WORKNAN'S COMPENSATION, for accident, injury or death, ACCIDENTAL BREAKDWN OF MACHINES OR BUILDING including loss of power which may bring down disaster and loss of finance on the enterprise.

All the aforesaid factors may contribute to close the chapter including the energy of the promoters. This is where the Insurance plays it's part by covering every loss or disaster in part or full by issuing a policy for every item for a small permium. So it is necessary to include the cost of insurance while preparing the estimate as well. A sure way to safeguard the unforeseen loss is to be insurance-conscious. Prevention of loss or leaks leads to the prosperity of a Nation resulting to a better social amenities and lower taxes for the people with improved standard of living.

At present people's back is almost broken with the load of high taxe and sky high cost of living with disproportionate income. In addition almost every family has to bear the pain of supporting their unemployed members, educate their children at a unreasonable cost and medical expenses also following the same pattern with social obligations and other expenses to follow the middle class families are generally the victims of this created torture who has to suffer silently being sandwitched in between the top and bottom class. Regular employment and increased earning capacity may only solve this problem which is to be done by industrialisation only. The almost dead nation then may have a chance to rise again from the ashes. The destructive methods now followed by a certain class of the society will then stop altogether.

Now is the time for all men with brain and brawn and unity of thought and action to assemble together under the same banner to clear off all the assembled causes of destruction. Finally before closing I must insist on the stoppage of all unnecessary expenses as detailed above for obvious reasons, Society should also be got rid of beggars by prohibition. Let us force our providence to help us building a healthy and clean nation on a foundation of self help. Let us cast aside the antediluvian social order of hesitancy and walk into the light of a new life. Good Night.

BARC-DEVELOPED HIGH VACUUM EQUIPMENT TO BE MADE BY IBP

Highly sophisticated high vacuum instruments and systems developed by the Bhabha Atomic Research Centre (BARC), Trombay, are to be manufactured by the Indo-Burma Petroleum Company (IBP) at Bombay, under an agreement entered into by the parties on April 4.

For more than a decade, the Technical Physics Division of BARC has been engaged in research and development work in the area of high vacuum technology. As a result of this effort, it has perfected the technology for making a complete range of high vacuum generating and measuring instruments such as diffusion pumps, valves, thermal conductivity and ionisation gauges and their respective electronic control units, as also several complex high vacuum systems and equipment including mass spectrometers, leak detectors, electron beam furnaces, freeze drying units, and vacuum coating plants, etc.

The Indo-Burma Petroleum Company has already made its mark in the field of electronics through its electronics Manufacturing Division with products like temperature controllers, medical electronic instruments, and also sophisticated systems such as automatic bottling plants and similar equipment. The electronics manufacturing division of IBP will now extend its activity to various vacuum components and instruments. Under this new IBP-BARC agreement, the results of the research and development efforts at BARC in the field of vacuum technology would be available to IBP on a continuing basis. Expert advice on specific turn-key projects, tailored to the customers' needs, would also be given by BARC scientists. The agreement thus emphasizes continued technological colaboration between a research and development organisation like BARC and an industrial manufacturer.

BARC has been successful in transferring processes and knowhow from time to time for industrial exploitation. The Electronics Corporation of India Ltd., at Hyderabad, and the Uranium Corporation of India Ltd., at Jaduguda in Bihar, are based entirely on the knowhow and processes developed at BARC. These companies however have grown under the aegis of the Department of Atomic Energy itself. The IBP-BARC tie up is a new arrangement wherein BARC is collaborating with an industrial unit outside the DAE family, on a commercial footing. The Government of India, incidentally, has a controlling interest in the Indo-Burma Petroleum Company.

(*Nuclear India, April, 1973*)

ERRATA

Typical Problems to the Disposal of Sewage from Isolated Buildings and Small Communities
(June 1973 issue)

Page	Read	in Place of
51	P. H. Act of 1938 "where"	"which"
51	movable "receptacle" in 3 places (3.2, 3.3,3.4)	"receptable"
53	Rt. side 6th line which "should not be closer"	"should be closer"

SCIENCE & ENGINEERING

JOURNAL OF INDIA SOCIETY OF ENGINEERS

VOLUME XXVI
NUMBER 8
SEPTEMBER 1973

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Popular contributions on scientific, technological, engineering industries and other allied subjects are invited for publication.

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SCIENCE & ENGINEERING

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SWORD OF DAMOCLES

Damocles, a courtier of the State of Syracuse, once praised Dionysus the Head of the State for the prosperity of Syracuse. At a next meeting Dionysus caused a sword to be hung by a thread over his dinner table at which Damocles and others had been invited. Damocles was surprised, but Dionysus explained how fragile was the prosperity of Syracuse and how dangerous it was to remain complacent.

The position of all developing countries and also of India is like that of Damocles and his friends with the Damocles's Sword hanging over the head by a bore thread. At the slightest mistake the sword may fall and damage the state's prosperity efforts.

In India the Second Plan laid great stress on industrialisation at the expense of agriculture ; the country had to pay for this mistake during the Third Plan subsequently when there was acute food shortage, and prices in all categories spirallied up. Similarly measures to lengthen human life has added to population growth and fast urbanisation and environmental pollution. Raising of agricultural products by irrigation has also led to use of fresh water and the threat has been added that the world may exhaust all conventional sources of fresh water by the middle of the 21st Century.

With increased sensivity to the cousequences of such activities, we can seek alternative means to achieve the same ends. We can plan new kind of urban areas to handle the world's increasing population. We can improve the water development and management techniques while increasing the agricultural output by greater utilisation and control of precipitation.

Looking to Green Revolution, the 'Miracle Seeds' have prospered the irrigated lands, and nations are proud of the technological break through. But it has been pointed out by UNO experts like Irving S. Fieldman that the high yielding seeds have in some areas displaced the low-yielding pulses and oil seed crops which have greater protein value. This has affected mostly the poor whose sources for obtaining requisite amount or protein is limited.

This should lead to a thinking that in future we should include dealing with the consequences as part of the original decision. Qualitative judgments are possible, and these may lead to choosing alternative methods of achieving objectives that have less attractive calculated cost / benefit ratios, but which may be more beneficial on balance when these non-qualitative factors are taken into account.

In developing countries, and in India too, we have broadly two sets of problems : those which are inherited from the past, and those which are generated by the process of change itself. However there is no choice but to change. Existing conditions for much of humanity is simply intolerable and unacceptable.

Taking the second problem first, the present picture in developing countries is appalling. The successes of past developmental efforts have increased output capacity in industry and partial escape from the drudgery of rural existence to a potentially fuller life exemplified by the cities, improvement in transportation and comminications wider educational and medical facilities, and sanitation in urban areas mostly. But these progresses have also created new problems and more dis-satisfactions in urban and industrial life. One of these, unemployment, looms large.

Thus the problem resolves to how to move from anger, disillusionment, and frustration, which deprecates the progress already made and hampers further progress, to conditions in which progress can result in a sense of achievement and renewed self confidence. Despite limited available means optimism and tolerance can be generated as obstacles are never insuperable. Although there is no inevitability to progress, there is neither inevitability to failure. Hence the continued existence of disturbing economic and social conditions, as we meet in India today, are inevitable, and should not be taken as signs of failure or lack of ability to cope with problems.

Inherited problems, again, are mostly well known ; subhuman conditions of poverty and inequal distribution of wealth, and malnourishment are to mention a few. The efficiency of the industrial and agricultural sectors are also not high, and the banking facilities and legal systems are not adequately geared to the complexities of world economy. The population also lack the experience is dealing with international business, and there is public fear of foreign Governments and nationals.

Thus these conditions interact and weave a thin thread from which is suspended the Sword of Democles. The inherited and newly generated problems require a comprehensive approach which should recognise the inter-relationship of these problems. The policy makers in India and other under developed countries have certain clues as to whether right decisions are being made and adequately implemented. These are largely the Press, the Legislative Assembly and the voice of the population, particularly on rural side. However the persistence of inflation and a distorted price structure suggest the need for possible modifications in the economic and social policies. Here the remedy should aim at not simply to eliminiate these symptoms. but to enable the country to continue to the maximum extent possible efforts to achieve the desired economic and social changes.

The policy makers have therefore to remember that (1) Reaching a general concensus on the major principles of a national value system should identify the most important social and economic objectives of the nation. (2) Deciding what means are regarded as acceptable for achieving social and economic objectives, and laying the same on sound foundations. (3) Formulating concrete policies and designing specific institutions which can implement the national development strategies in a practical manner. (4) Choosing investments in such a way that economic and social development programmes can be better protected from social tensions and inevitable major political changes, implying in the programmes public acceptability. (5) International positions and prospects should be clearly understood and be refleeted in the development strategy, and should include international assistance to projects that create more employment, improve the income of the poorest groups, or ameliorate urban conditions.

CLASSIFIED REGISTRY OF ISE MEMBERS

It has been decided to prepare a Registry of Members in all grades Classified according to Sates they belong to and specially, to the Division of Engineering of their respective proficiency, like Civil, Electrical, Mechanical, Chamical, Mining, Electronics, Tele-Communi cation, Industrial, Naval, Architecture etc. Members are therefore requested to intimate to the Office of the Society, the Division they wish to be listed under as also their service / business and postal address in full for the purpose.

WATER — THE PERVASIVE RESOURCE

By

Prof. George Alexander, B. Sc., B. E., M. Sc., (Eng'g.), F. I. E., M. I. S. E., Professor of Civil Engineering

and

K. Achuthan, B.E. (Hons.), M. Sc. (Eng'g.), Mem. I.G.S., Mem. C. S. I., (Non Member)

Reader in Civil Engineering Annamalai University Annamalainagar, Tamil Nadu.

Some are rolling in wealth having all the luxuries of life thrust on them others cannot get a morsel a day ; some keep on giving charities, others go on begging ; some order, others obey ; some are carried in cars, others pull rickshaws and though the universe is sustained on such disparities, there is none so glaring as has gripped the nation recently, which has affected millions.

On one side there is flooding, on the other there is drought. But while floods inspite of the damage like a penitent child, a loving parent or a benevolent master never go back without making amends or paying for loss, drought like merciless marauder, leaves only devastation and death in its wake.

Plants and animal require water for their sustenance. That water is life can only be realised in its dearth. So long it is available in abundance its importance is seldom realised. An entry in dry regions of earth, brings home how far scarcity of water can affect life. Towns are rare, villages are at far off distances, vegetation is scarce, trees are seldom met with and their growth is stunted, birds are few and only such of the animals that can traverse long distances for water e.g. the deer or those that can store water for some days in their system like the cameloid and to an extent bovine classes alone are seen.

The science of water is Hydrology ; it is the branch of geophyscis that deals with the hydrological cycle of water in its natural form above, on and within the ground. The basic source of water is precipitation, but in most parts of the world its occurrence is irregular and, to-date, practically uncontrollable. Fortunately, nature provides a great basic system of control and collection and man adds to these his own development.

We are dependent for fresh water on rainfall, on lakes, rivers and springs on underground and man-made reservoirs

and for salt-water on the sea. It has been estimated that in a year some 400,000 cu. km. (96,000 cu. mile) of water returns to earth from the atmosphere as precipitation. Of this, the land receives 100,000 cu. km. (24,000 cu. mile) of water while the ocean receives 300,000 cu. km. (72,000 cu. mile) of water. All this water again goes back to the atmosphere, about 3,37,500 cu. km. (81,000 cu. mile) evaporating from the oceans and 62,500 cu. km. (15,000 cu. mile) evaporating from land. The excess of evaporation from the ocean over the precipitation amounting to 37,500 cu. km. (9,000 cu. mile) of water obviously must come to the ocean as run-off from the land. This means that out of the 100,000 cu. km. (24,000 cu. mile) of water precipitating on the land, about 37,500 cu. km. (9,000 cu. mile) of water or about 30 per cent of the total precipitation runs off from the land to the sea. The other 70 per cent of precipitation stays in the soil for a while and then evaporates and transpires, into the atmosphere.

Nothing that man can do will ever appreciably change the amount of precipitation of land. The forces that produce it are too vast. But man can to some extent control and conserve the amount of water running off from the land, thereby increasing the amount available for his use and decreasing the amount that causes disastrous floods and damage. This is to be done by building dams and reservoirs on sites selected with the help of hydrological and hydrometeorological studies.

The habits of men and the forms of their social organizations have been influenced more by their close association with water than with the land by which they earned their bread. Even marriage might be influenced by the difficulties of obtaining water. The inhabitants of one rural community in south eastern Asia must walk 9 miles to the nearest sources of drinking water — a group of wells. Local custom decrees that wives must fetch the water. One wife can make only one trip a day with her bucket — not enough for the family's needs — and so a man finds it desirable to have several wives.

In the USA it was forcefully advocated by the ex-President, Mr. Lyndon Johnson, when he said :

"A Nation that fails to plan intelligently for the development and protection of its precious waters will be condemned to wither because of its short-sightedness. The lessons of history are clear, written on the deserted sands and ruins of once proud civilisation.

AUTUMNAL (SHARADIA)

We take this opportunity with pleasure to express our hearty Greetings to all our Patrons, Friends & Members with a sincere desire for their happy, easeful and progressive journey on the uneven path of eventful life.—*Editor*

A Rejoinder to

Manufacture of Mineral Treatment and Ore-Dressing Machineries in India

By

L. P. Molnar, M. & E. E. (Budapest), A.M.I.P.E. (London),
M. I. I. F., M. M. G. I., M. I. I. M. E., F. I. S. E.

(*Published in April 1973 issue*)

Following is the List of Plants and Machinery designed and manufactured by Late L. P. Molnar — Managing Director — Mining & Engineering Private Ltd., of 4/1, Camac Street, Calcutta in their Calcutta Works which are 100 per cent indigenous and have been supplied over many years to Industrial Projects all over India.

1. Cone Crusher	... 30″, 51″ Bowl dia.
2. Coal Crusher	... 50T/hr. to 300T/hr.
3. Twin Roller Crusher	... As per clients requirement.
4. Jaw Crusher with Granulator attachment	... 16″x5″ to 36″x8″.
5. Jaw Crusher with or without Rotary Screen	... 16″x9″ to 48″ x 64″.
6. Swarf Crushing & Cutting M/c.	... 2T/hr. to 10T/hr.
7. Hammer Mill — simple & reversible	... Any size & capacity.
8. Impact Breakers — beaters and/or roller type	... As per clients requirement.
9. Micronizers	... —do—
10. Pulverisers — Air Swept	... 30 lbs/hr. to 200 lbs/hr.
11. Multicage Disintegrator	... upto 150 HP size.

12. Vibrating Screen — single, double & multi-deck for dry & wet screening	... 2′ x 5′ to 6′ x 15′
13. Dry Cyclone	... As per clients requirement
14. Bag Filters	... —do—
15. Hydrocyclone	... —do—
16. Hydro-Classifier	... —do—
17. Pulp Distributor	... —do—
18. Concentrating Table	... —do—
19. Flotation M/c.	... —do—
20. Conditioner	... —do—
21. Eccentric Jigs	... —do—
22. Mineral Jigs	... —do—
23. Universal Jigs	... —do—
24. Bucket Elevators	... —do—
25. Belt Bucket Elevator	... —do—
26. Belt Conveyor	... —do—
27. Belt Feeder & Weigher	... —do—
28. Mobile Conveyor	... —do—
29. Portable Conveyor	... —do—
30. Mobile Loader	... 50T/hr. to 100 T/hr.
31. Digger Loader	... —do— Trenching 3′ deep.
32. Mixer Homogeniser	... As per clients requirement.
33. Cube Mixer	... ½ tonne to 2T/hr.
34. Muller Mixer	... Any standard size.
35. Fluid Coupling	... 2 HP to 500 HP.
36. Briquetting Press	... 3T/hr. to 15T/hr.

37. Friction Screw Press	...	Upto 300 tonnes Pressure.
38. Horizontal Double-headed upset Forging Press	...	As per clients requirement.
39. Drop Forging Hammer	...	Upto 200 Kg. weight.
40. Oil Fired Removable Top Muffle Furnace	...	As per clients requirement.
41. Oil Fired Revolving Plate Conveyor type continuous operating stud heating furnace	...	—do—
42. Super high intensity Magnetic Separator	...	—do—
43. Magnetic Filters for removal of iron particles from liquid materials	...	—do—
44. Drum-type induced miniature multipole Magnetic Separator for glass sand purification.	...	—do—
45. Suspended type magnetic field tramp-iron removers used over belt conveyors where the drum-type separators are inapplicable	...	—do—
46. Lifting Magnets of various capacities for use of foundry and steel processing plants	...	—do—
47. Fluidising Furnace Dryers	...	—do—
48. Regenerating Lime from paper & sugar mills lime sludge		—do—
49. Cement Plant	...	50T/day to 200T/day.
50. Modulisers & Pelletisers	...	As per clients requirement.
51. Vertical Shaft Kiln for cement, lime calcination and ore pre-reduction	...	—do—
52. Indirect heated rotary calciners	...	—do—
53. Drum-type Abrasion Testing Apparatus	...	—do—
54. Intermeshing Crusher	...	—do—
55. Pan Grinding Mill	...	—do—
56. Squeezer Dryer	...	—do—
57. Airlock Feeder	...	—do—

Incidentally, here are given some of the Major Projects undertaken and executed abroad and in India by Mr. L. P. Molnar.

1. Agricultural Machinery : Reaper-Thresher, Dry Fertilizer Distributor etc.
2. Agricultural Pump : Single body multi-stage Pump patented.
3. Projecting, re-designing, erecting and commissioning of Globus Printing Plant, the biggest in Hungary.
4. World Printing Exhibition, Budapest.
5. Corrugated Cardboard Manufacturing Plant.
6. Complete Plant for ERW pipe manufacturing.
7. Designing, erecting and commissioning of all the plants for manufacture of 1000 bicycles a months (1940) .
8. Container development and steel barrel manufacture—War Efforts.
9. 10′ all geared Lathe.
10. Cylindrical Slide Toolroom Lathe.
11. First motorised all-geared Shaper.
12. 16—Table Locomotive - wheel Balancing Machine.
13. Designing & Making Flotation Machine, Jigs & Milling Machinery, for metallic ore treatment.
14. Designing the complete Plant for the production of 50,000 tons Ferro-Manganese per annum,—the entire plant, except for the electrical control gear, was manufactured indigenously—Erection & Commissioning in 11 months according to schedule.
15. First Coal Crushing Machine — recognised best in India.
16. Counter-balanced Vibration Screens.
17. Coal Crushing & Delivery Plant for Indian Aluminium Co. Ltd., Muri.
18. Coal Crushing and Delivery Plants for Calcutta Electric Supply Corpn. Ltd., Calcutta — For Cossipore Power Station and for Southern Generating Station.
19. Variety of Machineries for Defence.
20. Pelletisation and Briquetting reject ores, coke breeze and coal powder for Defence Metallurgical Research Laboratory and for National Metallurgical Laboratory.
21. Jay Crusher — all steel mobile Crusher with Screens.
22. First Swarf Crushing & Cutting Machine.
23. Designing, making other complete Ore-Dressing, Mineral & Metallurgical Processing, Crushing, Screening, Conveying Plants/Machinery with 100% indigenous materials.

24. Machinery for Refractory & Cement production :

Rotary Kiln, Ball Mill, Rod Mill Classifier, Shaft Kiln, Klinker Grinper, Heat Exchanger, Pan Mill, De-airing Press with Brick Cutter, Hydraulic Press, Friction Press, Double-action Press, Homogeniser, Pulveriser, Microniser, Brick-Kiln, Continuous Kiln, Manchester Kiln, Rotary Drier, Indirect-heated Calcining Furnace, Fluidised Bed Furnace.

25. Agricultural Pump — Single stage but treble capacity and double lift for efficient irrigation, for deep mine application and also for domestic purposes — suitable for Diesel or Electric Motor as well as for hand-drive.

26. Mechanical Handling Machinery with Special reference to Bulk Loading, Unloading, Reclaiming, Conveying, Stock-piling of Materials : Belt Conveyor, Bucket Elevator, Belt-Bucket Elevator, Digger-Bucket Loader, Mobile Conveyor, Portable Belt Conveyor, Reclaimer and Stockpile Loader etc.

27. Patent — Direct Reduction of Metallic Oxide Ores by HF capacitative and inductive heating and continuous casting method, Indian, Sweedish, British, Swiss and French Patent.

SPECIAL ANNUAL FEE FOR ISE MEMBERS

Attention of the members of all categories is once again drawn to the Resolution adopted by the the Executive Committee at its meeting on December 15, 1972, enforcing that "Every Fellow and Member will be required to pay a SPECIAL ANNUAL FEE of Rs. 20/-, Associate Member Rs. 15/-, and Licentiate and all other non-Corporate Members Rs. 10/- failing which he will cease to receive copies of the Society Journal or enjoy Library Service and other benefits."

Members who have not as yet sent their Special Annual Fees for the current year are requested to remit the amount due at an early date.

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SCIENCE & ENGINEERING

Volume XXVI No. 9 October 1973

BROKEN UP STREETS AND PILING REFUSE

When sixty years ago many of us were young boys it was a pleasure to see with the local gong striking three in the afternoon, the street hydrants to bubble up with the touch of the hose-man, and the familiar features of hoseman scouring the street, and the footpaths with gushing water from the hose. In other times the vistiwala would water the streets from his leather pouch. In those days it was a daily affair to have the streets cleaned and to wash away all dirts. In the morning and afternoon too, the sweepers with their hand refuse carts were familiar sights, coming in view with jingiing noise over the cobbled streets, and to see them working hard with brush and refuse dish, and we were sure the streets were then spotlessly clean. It was the same old Municipality of Calcutta, but now the workmen and the watering and scavenging squads are not the same. The horse drawn refuse carts have given place to motor refuse lorries, and for sometime with covered lorries, but now the refuse lie in the open not only in the street corners and at select dust bins, but every where. The gutters and side drains are suffocated with refuse. The parks are loaded with refuse and piles of refuse lie unremoved from month to month and year to year and turn into mounds and then into small solid hillocks. They creep on to the middle of the streets and overflow footpaths It becomes impossible to distinguish which is footpath and which is vehicular drive. And yet even upto the British period in our City's history, the streets were tolerately clean. The suburbs were cleaner, the city centre clean, the drains and footpaths around the Governor's house clean, and not over grown with shrubs or filled up with refuse, as we witness to-day.

This marked deterioration in our civic cleanliness is not the work of a day. The old administration is not there. The City fathers have gone away, we have a new civic administration with the Government directly responsible, and a Minister sitting over the head of the administration, and yet the refuse is piling up. Let us make allowance for the increase in population, increase in floating population, increase in population who have no stake in the city and only want to earn and send back money out of the State and dump the refuse in the State and in the city, and in the city's centre. Even with all these, it is a question why this refuse piles up from day to day spreading disease. We come back to the same answer ; the men in authority are not the same, the workmen and scavanger squads are not the same, and the peoples' habit is not the same as before.

What then is the remedy to prevent this piling up of refuse in the city and suburbs, and in fact in every town more or less in the State. We know Delhi and Madras, Coimbatore and Bangalore, Hyderabad and Bhopal are refreshing changes and so more or less Bombay. Indeed the population is heavy here in Calcutta but the problem is not insurmountable.

The remedy lies in placing things in their proper perspectives. This is : not only the refuse has to be removed, but if we go deeper into the problem at its source, the refuse should not be allowed to grow and accumulate and be thrown on the streets. For the first, we have to change the set up, namely change the administrative set up, change the mode of scavenging and change the scavengers and workers who have failed in their work, and change the method of payment. For the second there is need to impose heavy penalty for those who pile refuse and make dirty the streets, including the common pedlars, and make shift footpath shops, and pedlar shops inside parks. Unless the thought of vote catching is given the goby, and civic necessity is put in the forefront, a Chief Minister's bustle and noise, a Minister's decorative presence over civic administration will secure no purpose. Catch hold of the people responsible for dirtying the streets and dirtying the city, and deal with them firmly. The refuse will then not grow, and removal of refuse will come down to a manageable scale.

The unauthorised khatals in the city, endless in number, at which the Corporation of Calcutta and the administration look on with blinking eyes, carry on mainly their profession of creation and out flow of refuse and putrifiable matter on to the streets and lanes, and churning up of the streets into knee deep muddy slushes. The impassable streets with stray buffaloes and bulls in any number appear to be nobody's property, though they are counted as municipal property when prepairing

the city rate bills while the house holders pay both the municipal rate bills and suffer the refuse, these khatal owners scarcely pay a single rate bill, and over loads the municipality with daily gifts of refuse, filth and squator and disease. No body barks when this camel of squator and refuse passes.

In the old days it was pleasant to walk along footpaths in busy streets in the city of Calcutta. We are speaking of the years between 1912 and 1945. The pleasure is not there now. Even of necessity you have to avoid the footpaths and take to some jay walking. In fact the footpaths as we knew them are no longer there. They are only shambles, ghosts of footpaths, what with the litter of refuse, piles of construction men's dumps of stones, rubbles and earth, unrepaired stretches of achievements of the cablemen. And yet as a rule the cablemen deposited to Corporation of Calcutta the costs for repairs in advance. The money has vanished. While the footpaths before Raj Bhavan may have been repaired four times in two years, other stretches within a stone's throw lie torn up for years together long since the cablemen had gone away after their work was done. And not only those ram shackle structures of street pedlars now adorn the footpaths and block them, the 80% of the population who are foot trafficckers are expected to take hurdles over those broken jammed foot lanes, and break their heels. Now who are the people responsible for these broken footpaths. Obviously the Corporation of Calcutta, with the deposited money used up in other accounts, with license granted for obstructing footpaths and permission to pile up construction materials taken out from carriage ways to be heaped up for months and years on footpaths. In fact the city footpaths have not vanished of themselves, they have been made to vanish by men, by administratlon who are supposed to build and to maintain footpaths. No wonder our city once called the city of palaces, the second city of the empire where the sun never set, has now no footpaths, and has only piles of refuse. The city police is mum. They are street dolls, they have no function except to nod their heads with the political breeze and to keep mum. The Police Chief is better cushioned away in his cosy cool seat than to walk on toe tip for an inspection under a blazing sun over the dirty humps and through pedlars' shanties, over what one would scarce recognise as a footpath. It is a common sight to see loaded buses with precariously hanging people scurrying along carriage ways through medley crowds that cannot walk along footpaths.

And yet we are planning for newer cities, newer city centres, newer townships, to hold our increasing population when we do not want cleanliness in habit, when we do not want to keep the cities clean.

As if to add to this paradox the CMDA is throwing Rs.70 Crores into the city's streets, and at the same time digging deep and turning the bowels of the streets inside out and just leaving the streets like that. It has added its full quota of slovenliness and mismanagement, and converted the city's streets into quagmires, and vanishing

streets. A man in the city streets is now worse off than if he were in the famous subterranean catacombs of Paris. Men have been known to have vanished for ever through the city's open lidless manholes, and CMDA have contributed no less to such lidless manholes.

It was a familiar sight in the old days to see the heavy steam rollers diligently puffing away steam and smoke, and crunching over the streets and daily repairing the streets. Most of these steam rollers have been replaced by light diesel road rollers. Even then it is a common sight to see them for most part of the day idling away, and the streets lie unrepaired for ages. Look at the joint work of Calcutta Improvement Trust and CMDA at Tollygunj Tram Depot corner. The new joint ventnre which they flare before the public eye over a gaudy signboard has no relation to the work they do. In fact a furlong length of street widening is left just that unfinished for about a year. In fact nothing moves. Things do not move because the minds do not move, because the administration does not move. Hence the city's progress does not move and in the meantime rubbles and debris and broken-up streets, torn up footpaths, whorls of mud and slush are before one's eyes to sooth them, and before the World Bank's eyes too. It is said the CMDA is unable to use up all the money allotted to them, and yet the CMDA is unable to move the stones and finish the works. Teams are running to U.S.A. and where not, only they are not on the workspot. The street scavengers, road repair gangs are every where, at every union meetings, only they are not at worksite working dilignetly. The administrative chiefs are there in there cool corners in cosy chairs. Files pass, files accumulate and ultimately files vanish under the piling dust.

What is needed is to slap off the dust inside and to sweep off the refuse outside and to keep the men concerned twirling about on their work. If there is an administration which can do it, then it has passport to stay, or else it should go. The country is fed up with bluff and bluster, it wants solid work and money's worth.

There are many areas where 'prevention' might be the most expedient means of 'disposal'. Regarding problems of collection and disposal, collection must to some extent be handled separately from dirposal, although in the ultimate analysis they are interdependent. Quon et al studied a mathematical simulation of a refuse collection system and examined a system of parameters concerned with collections, including crew size, size of truck, length of work day, overall collection efficiency and related them to system characteristics such as quantity of refuse, daily and reasonal variation in quantity etc. This type of study is of course clossely related to the size of the collection system, and the location of the ultimate disposal site.

Collection of refuse may be based upon a number of technical considerations. Studies might be based on improvements in automatic handling devices, separation of putrescibles from non-degradible wastes, by the first handler (house hold, factory etc.). Solid wastes can be pipe-lined in some manner. The use of a train for haulage over long distances may assist in better utilisation of a poorly used existing railway line.

Typical quantities of community refuse, as we know them are :

Municipal refuse (20 % moisture) total solids 4 to 8 lbs./Cap/day, G.W.; Residential Refuse (20% Moisture), total Solids 2.0 lbs./Cap/day, G.W. (gross weight); Residential grabage (72 % moisture)—Total solids 0.5 lbs./Cap/day G.W. ; Municipal sewage total solids 0·55 lbs./Cap/day D. W. (Dry Wt.), suspended solid BOD 0.121 bs./Cap/day D. W.

There are various processes for refuse disposal, — these cover separation, grinding putrescibles, sanitary land files, composting, incineration, pulverising, and finally the new process of pressing and balling, a Japanese technique.

However whatever be the steps recomended by the experts, for removal and disposal of refuse, the main thing the people want to see is that, things must not just stand still, that administration and workers must move conjointly, and slackness should not have room any where to grow, whether in the administration or with workers, and the people who create the refuse on the public streets should be dealt firmly to prevent creation of refuse at the source, and the footpaths must be true footpaths in the literal sense.

CLASSIFIED REGISTRY OF ISE MEMBERS

It has been decided to prepare a Registry of Members in all grades Classified according to Sates they belong to and specially, to the Division of Engineering of their respective proficiency, like Civil, Electrical, Mechanical, Chemical, Mining, Electronics, Tele-Communi cation, Industrial, Naval, Architecture etc. Members are therefore requested to intimate to the Office of the Society, the Division they wish to be listed under as also their service / business and postal address in full for the purpose.

MARUTI

(THE PEOPLE'S CAR OF INDIA

By SUDHIN BHATTACHARJI, F.A.I.S. (Ind.) M.I.I.I., M.I.M.T. (Lond.), M.I.A.E. (Eng.), M.A.E., M.I.S.E.

Maruti is the brain child of Sri Sanjoy Gandhi. According to Sanskrit Dictionary Maruti means 'PAWAN NANDAN' or the famous monkey God of the RAMAYANA. In the old days when a motor car was introduced in India a popular name was given by the local people of India as HOWAGARI. So the name Maruti actually serves the same meaning as howagari as well as giving it a devine name. A good selection of name indeed and a purposeful one too. It is a motor car under proposed production. We bless the child for a successful future with congratulation to its father Sri Sanjoy Gandhi.

Sri Sanjoy Gandhi though born within an atmosphere of strong politics has narrowly escaped the clutches of the rotten atmosphere by becoming a designer and engineer. We welcome him to our folds as an energetic engineer with a courage and brain to travel in a path of creation and service. May God help him to proceed further in his chosen path with success.

The Car Maruti has taken shape and been tested for it's claimed efficiency. Though we have not had the pleasure of physically examining the car yet, but the specification received so far discloses the possibility of production of people's car which may claim an efficient and economical performance.

The conservative design has been discarded to reduce the cost of production, economical running and maintenance. The driver/owner with a technical mind will be able to keep the car in good running order without expensive repairs. I have come across such two cylindered 4 stroke, economic three wheelers in England (Morgan) which proved its efficiency in a long run as well as a round about in the city and suburbs. The tax should be reasonable either by weight or by H.P. according to R. A. C. formula (2 × D. cy × N. cys divided by 2.5)

Expl : Twice the diameter of the cylinder multiplied by the number of cylinders divided by 2.5.

The position of the engine in rear compartment will make the inside of the car less noisy and less hot. The drive, direct to the rear wheels through the gear box has taken off the extra weight of a conventional differential gear system which also allows a good road clearence and a plain floor. Other advantages over a conventional practice is given in the following specification. Further details when obtained from the manufacturer will be discussed later in the pages of SCIENCE & ENGINEERING in due time.

AN OUT LINE OF THE SPECIFICATION OF MARUTI

GENERAL DATA :

Engine - (Rear Mounted)

No. of Cylinders	...	... 2 (Vertical inlined Air cooled)
Bore	...	... 82 mm.
Stroke	...	... 64 mm.
Cubic Capacity	...	... 676 cc. 6.76 H. P.
C. R.	...	... 7 : 1 (BHP 28 SAE at 5000 rpm.)
Torque	...	... 7.2 Kgm. at 3000 rpm.
Lubricating arrangement	...	... Forced
Oil Pressure (Normal Running)	...	... 3 to 4 Kg./Cm^2
Clutch	...	... Single Plate (dry) 184 mm.

Gear Box

Constant Mesh	...	...	1st	IInd	IIIrd &	IVth
Over all Ratios	...	...	1st	—	1 :	14.68
			2nd	—	1 :	7.1
			3rd	—	1 :	5.83
			4th	—	1 :	4.20
			Reverse	—	1 :	13.25
Final Drive	...	...	Spur Gear			

Steering

Type	...	... Rack and Pinion
Turns — Lock to Lock	...	... 2.875
Turning Circle Between Curves	...	... 8 Meters.

Front Suspension	...	... Independent with coil springs. (Spring axles)
Rear Suspension	...	... Independent with coil Spring (Trailing Links)
Damper	...	... Hydraulic Telescopic
Brakes	...	... Hydraulic on all four wheels
Total Braking Area	...	... 600 cm^2
Fuel System	...	... Gravity flow
Body	...	... Monocoque Construction
Tyre Size	...	... $5.20'' \times 10''$
Luggage boot capacity	...	... 20 Cubic meters
Carrying Capacity	...	... 300 Kg.
Position for spare wheel	...	... Inside luggage boot in front

Over all Dimensions :

Wheel base	...	... 2263 mm.

Over all length :

Bumper to Bumper	...	... 3207 mm.
Over all width	...	... 1508 mm.

BRIQUETTE MAKING FROM REJECTED COAL OR COKE BREEZE

By

L. P. Molnar. M. & E. E. (Budapest), A. M. I. P. E. (London),
M. I. I. F., M. M. G. I., M. I. I. M. E., F.I.S.E.

This article was submitted for publication by Late L. P. Molnar before his unfortunate demise, we have pleasure to publish this important article herewith.

—Editor

Large stocks of powdered coal, also rejected coke breeze, are available from fertilizer factories, coke producing installations and from coking and non-coking collieries at extremely low procurement price.

Coke breeze if ground to a self-locking aggregate size of particles may be easily briquetted with appropriate binder for transport and utilisation in any part of India, provided this briquette producing method is up-to-date using latest processing methods of materials and machineries with the help of which hard domestic or industrial briquettes may be produced in size and forms as required.

Rejected coal, specially coking coal, contains high volatile composition, with the help of which the best possible briquette binder (combination of coal tar and pitch) may be made. The use of this type of binder ensures production of hard wear-resistant briquettes.

The freshly formed briquettes may be passed across a furnace for heat treatment to ensure that the binder utilised when forming the briquettes is fully carbonised. This method of production converts the compressed aggregate into fully carbonised, wear-resistant, hard, compressed briquettes, the shape of which may be so made that their utility either for industrial (Blast Furnace) or domestic (Fireplace) purpose may be made and at the same time permit recovery of presently rejected enormous wealth of the now unused coke breeze and/or coal fines lying stockpiled for decades.

If we think on the high volatile composition of our coking coals, the binder itself could be made in the Briquetting Plant itself and part of the raw material could also be utilised for heat-treatment of the briquettes produced, so that with complete carbonisation, medium or high pressure briquettes may be made of highly wear-resistant quality transportable to long distances without breakage.

Briquettes made by medium pressure are normally used for domestic or for steam-boiler firing. High pressure made briquettes are required in steel, cement, chemical and other industries, where they are subjected to heavy mechanical load or pressure, also to abrasion during firing.

To carry out the process, the raw material will have to undergo differential grinding on a specially constructed Roller Crusher, with the help of which the particles constituting the briquettes would give a granular size variation, whereby the so-called self-locking grain size aggregate would be produced to ensure the maximum compressibility of the raw material.

After crushing and regulating the granular composition, the raw material will have to undergo homogenous mixing with its liquid, eventually preheated and solid binders. The Homogenising Mixer with its revolving shell and the built-in two contra-rotating paddled mixing spindles could be used to deliver the raw material mixed with its binder in an absolutely homogenous composition to the feeder of the Briquetting Press.

The Briquetting Press having a "de-airing" progressive compression style taper-cone, single or double impeller feeding system, would pre-compress the material prior to its feeding into the variable compression powered Briquetting Press in which appropriately formed half cavities would be used under adjustable compression power to produce briquettes either for domestic or for industrial use.

The material coming from the Homogenising Mixer would be subjected to conveyance and pressurisation in the downward set apex taper-cone shaped conveyancing feeder operated by a diminishing diameter screw-conveyor. The already de-aired and precompressed feed material could be delivered under pressure retaining volumetric adjustment into the half cavities of the briquette forming rollers.

Pre-compression of the material across its feeding funnel would serve as an air-bubble-free delivery system, through which by regulating the delivered feed quantity the volume of material needed to produce more or less compression on the individual briquettes between the contra-rotating briquetting rolls is achieved. A special mechanical drive consisting of fixed and moving rollers permits the variation of pressure between rollers with the help of adjustable power spring actuated loading or hydraulic roller pressurising construction.

Briquetting cavities in the press could be made to conform either to domestic or industrial requirement and provided also with ventilating holes, the application of which would ensure easy and immediate ignition, specially for domestic firing and at the same time contribute absolutely uniform compression within the briquette body itself, whereby uniform strength of

the entire briquette in all possible mechanical load direction is ensured. The Briquetting Press producing the briquettes at fairly low revolution of the compressing rollers would contribute to the pressurisation of the briquettes before their discharge from the press.

Receiving Conveyor would collect the briquettes produced and permit the fall through or separate discharge of the material compressed between briquetting cavities. This fraction of fail briquettes would be immediately recycled to the Homogenising Mixer so that no material and binder loss would occur.

The ready briquettes containing coal tar and pitch composition binder would be conveyed to a heat-treatment furnace. Depositing the products on its malleable-cast Apron-plate conveyor moving across the furnace, the load would be subjected to pre-heating, semi-firing and after cooling sections of the indirectly heated chamber and cooling section of the furnace. The cooled briquettes could then be discharged either on to a radial-movement stockpiling conveyor or manually stockpiled.

It is conceived that heat-treated coke-breeze briquettes could serve the existing large scale steel industries in which the briquette size would be commensurate with the average coke size demanded for this purpose. It may also be utilised in ordinary cupola furnace or in industrial furnace or boilers etc., and other utility for which purpose the briquettes are conceived to be around 10/11 cu. inch volume and approximately $4\frac{1}{2}''$ to $5''$ diameter and $3''$ to $3\frac{1}{2}''$ thickness. For the purpose of domestic use the briquettes may be produ of $3''$ to $4''$ cu. in volume, maxim $2''$ to $2\frac{1}{4}''$ diameter, and $1\frac{1}{4}''$ to thickness.

The Briquetting Press capacity wo entail- production of briquettes betw single or multi-row cavity execution, w the help of multi-row feeding devices. the multi-row cavity roller execution, would be essential to sub-divide the feed discharge device into individual sectio Separate delivery openings leading to ea row to ensure the equality of feed volu to each of the compressing cavity rows the briquetting rolls would give unifo quality briquette production.

The furnace construction would per passage of ready briquettes across indirectly heated chamber in which t briquettes are first pre-heated then fi normally at 450°C or upto maximum 650 under adjustable temperature conditi and then cooled. The firing may be ma by rejected coal/coke breeze. Ordina medium temperature refractory lining m be used in the 'U' shaped firing cro section furnace. Ordinary cupola bricks appropriate size may be also used in t briquette heating chamber, while the pr heating and after cooling parts of t furnace might be lined with ordina refractory bricks ensuring long life und low temperature.

The malleable-cast Apron Plate Conveyo in continuous operation would be coole on its return way, when coming out fro the furnace and carried back to the feedi point of carrier roll conveyancing suppo

The capacity of such a plant should be made at least upto 3 to 4 tonnes/hr. so that in single shift operation, a closed wagon load may be produced each day.

The production costs are involving mechanical handling of the raw materials, its binders and the ready briquettes. Because of the small tonnage duty of the plant, a simple turntable conveyor with the help of variable inclination would permit the loading and unloading of the raw material at site at any desired position. A bucket elevator would carry the raw materials coming from the differential speed roller crusher into the Homogenising Mixer. After this the process is operated by automatic transfer mechanism so that again mechanisation is only needed to ensure loading of wagons in case higher capacity plant would be envisaged.

If the binder is purchased from oil companies or from coal tar and pitch distributors, the preliminary heat-treatment of the coke/coal briquettes would be eliminated. In this way capital cost could be reduced. With the help of furnace temperature regulation, the firing of the ready briquettes can be adjusted to produce the best quality at the rate of production capacity of the press.

It is needless to say that with the exception of Lygnite and Coal deposit areas in Bihar, West Bengal, Orissa, Madhya Pradesh and certain areas in South India, presently very large areas of the Country do require procurement of fuel. Their requirements both domestic and industrial could be met with the use of non-coking and coking type coal fines or coke breeze, from which materials the most economical production of briquettes for domestic as well as industrial use is practicable by fully tested process and machineries made for the purpose.

The Japanese have recently made substantial progress in briquette making and the briquettes made by them are in size, mechanical strength and also in their heat-content comparable to that of Blast-Furnace coke.

We too could definitely establish such Briquetting Plants to substitute at least to some extent the Blast-furnace coke, for the making of which pre-washed and exclusively large size lumpy coking coal is used.

Combination of coking and non-coking coals in suitable proportion may constitute a self-binding composition. This would permit the making of sufficiently large size briquettes of hardened and non-abraiding quality and high mechanical strength for use in our blast furnaces or wherein the firing of coal is required.

The constitution of such briquettes with the help of coking and non-coking coal mixture would allow the use of the binder content of coking coal. If the two qualities would first be pulverised, intermixed and so to say temporarily bound with primary binder, the briquettes after heat-t reatment would be equivalent to normally used blast furnace coke, completely hard, non-abrasive quality and of high mechanical strength and after heat-treatment fully carbonised, without any residual tar content.

It may be stated that the original volatiles and the pitch and tar content of the coking coal is a strong binder after carburisation.

Certain qualities of coal have been tested in India for the production of briquettes, mainly to provide fuel for boiler firing in tea gardens, at the same time for heat extraction of the volatile and tar contents of the particular coking coal into liquid tar which again is used as a binder or used for road building and for chemical purposes.

This type of briquettes could be made by utilising the presently rejected coal fines both in the coking and non-coking qualities, enormous quantities of which are available at low cost. Similarly it would be practicable to make use of coke breeze now rejected on account of its fine particle size which could substitute the non-coking coal addition. In both ways tremendous economics can be achieved in making industrial briquettes so badly needed for our steel plants.

The capital investment even for the largest briquetting plant unit, having a capacity commensurate with the consumption of any one of the conventional process large steel makers' requirements, would be comparatively small, even if the tar extracting and briquette carbonising furnace facilities of the required capacity are included. This type of briquette manufacture would very quickly permit the recovery of capital investment and utility of raw materials presently lying as rejects and unused.

EMERGENCY POWER FOR ELEVATORS AND ESCALATORS

By

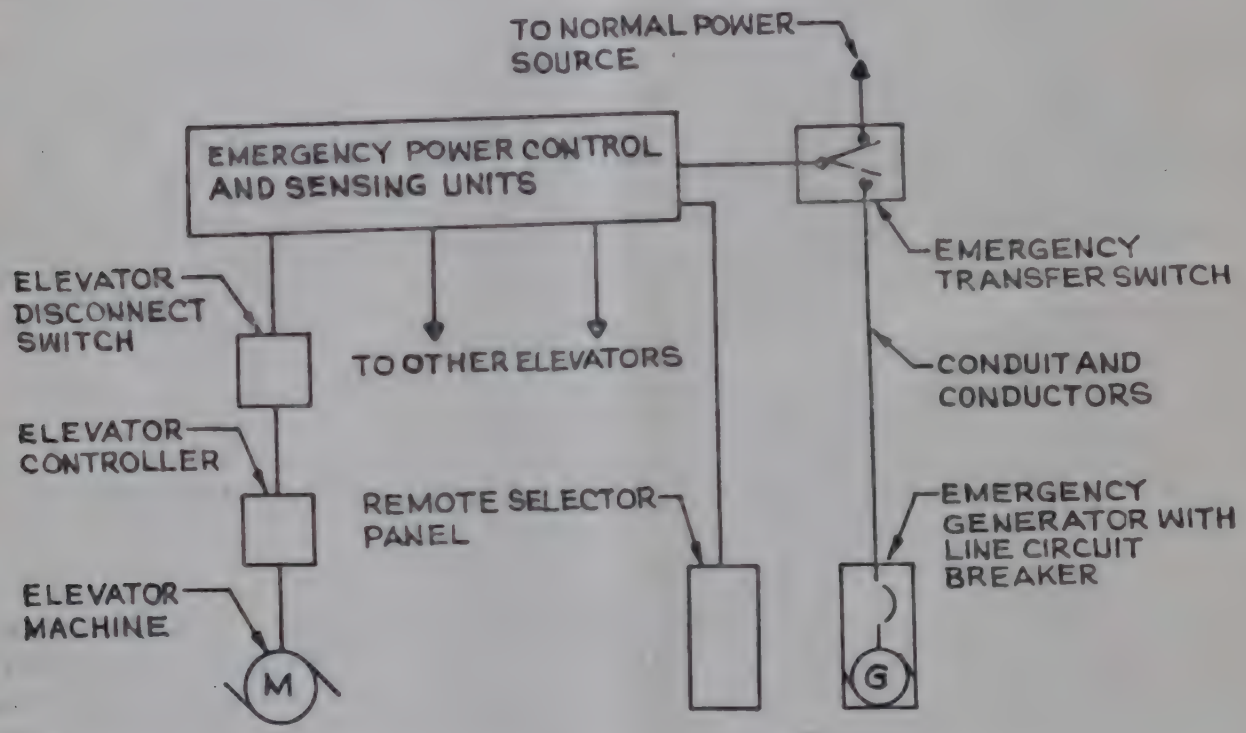
HEM CHANDRA CHATTERJEE, M.I.E.E.E. (U.S.A.), M.I.E.S (U.S.A.), M.S.W.A. (Canada), M.C.I.M. (Canada), VDE (W. Germany), Dip. B.I.E.T. (London), Dip. P.E. (Philadelphia), A.M.I.T.E., M.S.E.E. (Univ. of Pennsylvania), M.I.S.E., Chief Electrical Engineer, Vinokur Pace Eng'g Services Inc., Jenkintown, U.S.A.

To-day emergency power system is an essential part for elevators and escalators. Some states in U. S. A. have been passed the laws which require emergency power for all elevators and escalators. Interruption of power for elevators and escalators due to fire, fault or by any other acts in high-rise buildings or industrial systems may endanger human's life. There is no real source to know how many elevators or escalators are equipped with the emergency power source in to-day's India. Manually controlled emergency power for elevators is no longer reliable due to human errors. Therefore, automatic transfer switch and controls for emergency power system for elevators and escalators should be strongly recommended.

On a normal power failure the sensing and control logic initiates start of the stand-by emergency generator and the transfer switch automatically transfers the emergency power source to normal circuit. When the generator reaches approximately 90% of the rated voltage and frequency, a visual signal in the elevators selector panel indicates the operation of a particular elevator or escalator. The circuitry should be so arranged that only one elevator will be transferred to emergency power at a time. Otherwise a giant transfer switch and a big generator will be required to provide the emergency power to all elevators and escalators.

Upon restoration of the normal source, automatic transfer switch will automatically re-transfer all elevators and escalators to normal source.

In general, a transfer switch is a combination of multipoles grouped together and performs double-throw function by a single solenoid mechanism which is momentarily energized. The switch is inherently interlocked electrically and mechanically. Therefore, failure of any coil and malfunction or disarrangement of any part should not permit a neutral position. The switch is locked mechanically without any use of latches, hooks, springs or semi-permanent magnet. Separate arcing contacts are used



SINGLE LINE EMERGENCY POWER DISTRIBUTION SYSTEM FOR ELEVATORS

to protect the main contacts. All contacts should be silver surfaced for better performance and longer life For individual operation select one transfer switch for each elevator or escalator.

Voltage monitors are required to sense the acting power source. Voltage monitors initiate operation when normal voltage drops to 90% or less on any or all phases of the normal source. Upon restoration of the normal source, voltage monitors restore to normal operation. Approximate one second static time delay can be applied to over-ride outages. Momentary power dips and emergency operation may be initiated if the outage is sustained. Auxiliary contacts are used to start the stand-by engine-generator. Voltage monitors should be adjusted by the manufacturer for operation over environmental temperature range O°C to 50°C with 0.5% to 2% accuracy.

Selector panel contains separate push-button switches for each elevator or escalator. Pilot indicator lamps are also be included in panel to indicate (a) availability of the normal source ; (b) the emergency source ; (c) connection of emergency source to a selected elevator. Generally selector panel is enclosed in a flush type enclosure and placed in a well supervised location. Recommended control voltage of the panel should not exceed the available standard lighting voltage of the building. But there is nothing wrong if you use a step-down transformer for 24, 48 or 96 control-volts.

It is also recommended that after completion of the emergency power control system appropriate functional tests should be performed by the trained technician or engineer or by the representative of the manufacturer.

SOCIETY NOTES

PROGRAMME OF ACTIVITIES AND COMMITTEES

At the meeting of the Executive Committee held on September, 14, 1973, the following Sub-Committees were appointed with the respective members, to execute the different programmes of activities as cited below, under general supervision of the President and General Secretary.

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(Personnel as on Second Cover Page of the Journal)

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Shri P. C. Ray
Shri S. K. Ghosh

Convenor — Shri S. M. Sarkar

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(ii) Classification of members category and State-wise.

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Lt. Cdr. B. Mukherjee

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Shri V. B. K. Murthi.

(Members for Metallurgy, Mining and other fields of Engineering to be co-opted)

Terms of Reference :

Improvement of Technical matters relatin to import substitution and engineering policies.

SCIENCE & ENGINEERING

JOURNAL OF INDIA SOCIETY OF ENGINEERS

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SCIENCE & ENGINEERING

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PROBLEMS IN THE CHEMICAL INDUSTRY

The growth rate in the Chemical Industry in India was 14 per cent in 1972 against only 7 per cent in 1971. While this rise in growth rate is encouraging, it is to be noted that the annual growth rate of the industry in Japan is about 17 per cent. Hence our country must not rest with only 14 per cent growth rate.

The problems facing the industry, because of its diversity and complexity, is quite colossal. What is most needed in the industry is more sophisticated instrumentation and process control, and greater expenditure on R & D. Import substitution of knowhow is urgently required, also innovation and modification of indigenous technology and materials at lowest cost. To speed up technological advance Japan spends 3.5% of its total sales on R & D.

It often happens that the cost of maintenance of chemical plants and equipments is often found to be more in the long run than cost of actual purchase at the time of first installation. For this reason several aspects on maintenance for the industry have to be considered.

Regarding industrial waste treatment problems and disposal methods, what are needed for consideration are — treatment and disposal of industrial wastes and effluents in the industry, waste disposal by incineration, ash handling system, and fly ash-handling and utilisation in coal-fired boiler plant, tackling cooling water problems in the chemical process industries and treatment of waste for re-use in the process cycle.

Next on pollution problems, consideration have to be given to prevention, abatement and control of water pollution in process industries, formulation of short term and long term strategies for pollution prevention, planning for anti-pollution drive in chemical industry, pollution problems faced with coal-fired and oil-fired boiler plants, and anti-pollution devices and their effectiveness and economy.

Next, on corrosion and erosion problems, which is a major headache in the chemical industry. Considerations have to be given in the directions of corrosion and erosion problems faced. Prevention of equipment failures due to high temperature and low temperature corrosions, preventing corrosion in oil-fired boilers, corrosion and slagging with heavy fuel oils; flue gas desulphursiation, low excess air-combustion operation for steam generation and corrosion and erosion protection for the process equipment.

Then on maintenance problems, the industry has to grapple with problems like use of chemical additives as a maintenance tool for process industries, problems relating to industrial water treatment, chemical and mechanical cleaning methods for process equipments, condensers and heat exchangers, and predicative maintenance as a tool to predict process eqipment deteriorations.

Next vibration problems and non-destructive testing methods draw our attention. In regard to these, attention has to be given to dealing with vibration problems in the chemical industry and vibration analysis; on use of non-destructive testing methods and monitoring to locate defects, and wear and tear in the system.

Finally problems connected with process heating deserve special attention. In regard to these, special attention has to be given to heat storage in process industries, high temperature water vs. steam for large scale heating systems in the process industries, on use of steam, or high pressure hot water and high temperature oil system for process heating in the industry.

A successful tackling of these different problems can increase the operational efficiency and reduce maintenance problems, and cut down to lowest the maintenance costs for plants and equipments.

AN EXPRESSION FOR POISSON'S RATIO

By

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Professor of Physics, J. C. Ghose, Polytechnic, Calcutta - 9.

Abstract :

A new expression of Poisson's ratio has been derived in terms of resistance. The experiments were performed to measure this ratio in case of wires. The experimental and calculated values were found to agree fairly.

Theory :

Let R be resistance of a wire whose length is l and cross sectional area is S.

Then $R = \rho \frac{l}{S}$ .....(1)

where ρ is specific resistance of wire.

If this wire is suspended from a rigid support and a fixed heavy weight is attached to other end of this wire. Then wire will be stretched and length of wire will be increased to $(l + \delta l)$ and cross sectional area will be decreased to $(S - \delta S)$, then R′, the resistance of this stretched wire, is given by

$R' = \frac{l + \delta l}{S - \delta S}$ .....(2)

where δl is small increase in length, δS is small decrease in cross sectional area.

Since the volume of wire remains constant.

$\therefore \quad lS = (l + \delta l) (S - \delta S)$ .....(3)

or $lS = lS + S\,\delta l - l\,\delta S - \delta l.\ \delta S$

or $S\,\delta l = l\,\delta S + \delta l.\ \delta S = S (l + \delta l)$

or $S \frac{\delta l}{\delta S} = l + \delta l$

Divide both sides of above equation by l

Then $\frac{S}{l} \cdot \frac{\delta l}{\delta S} = \frac{l + \delta l}{l}$ .....(4)

Divide (2) by (1)

$\frac{R'}{R} = \frac{l + \delta l}{l} \cdot \frac{S}{S - \delta S}$ .....(5)

Putting the value of $\frac{l + \delta l}{l}$ from (4), equation (5) becomes,

$$\frac{R'}{R} = \frac{S}{l} \cdot \frac{\delta l}{\delta S} \cdot \frac{S}{S - \delta S}$$

$$= \frac{\delta l}{l} \cdot \left(\frac{S^2}{S - \delta S} \right) \cdot \frac{1}{\delta s}$$

$$= \frac{\delta l}{l} \cdot \frac{S^2}{S\,\delta S - (\delta S)^2}$$

Since δS is a small quantity, therefore $(\delta S)^2$ is neglected, so that the equation will take the form

$$\frac{R'}{R} = \frac{\delta l}{l} \cdot \frac{S^2}{S\delta S} = \frac{\delta l}{l} \cdot \frac{S}{\delta S} \quad \ldots\ldots(6)$$

So long as longitudinal strain is small, the lateral strain is proportional to it. The ratio of lateral strain to longitudinal strain is Poisson's ratio and is denoted by ρ

$$\rho = \frac{\delta S}{S} \Big/ \frac{\delta l}{l} = \frac{\delta S}{S} \cdot \frac{l}{\delta l}$$

So that (6) becomes

$$\frac{R'}{R} = \frac{l}{\rho}$$

or $\rho = R/R'$ .....(7)

in consideration of equation (7), since the maximum value of $\rho = 0{\cdot}5$, therefore the maximum value of R′ will be equal to 2R. The equation (7) also gives us an idea of direct measurement of Poisson's ratio in case when substances are available in form of thin wire.

Experiments :

A metallic wire of 20 metres long and of diameter ·2 mm was taken. This wire is suspended from a rigid support. A small weight is attached to free end of wire in order to free it from Kins. The P.d. terminals were taken from two ends of the wire. Its resistance was measured (drop of potential method) by a potentiometer. It was noted. Next, a weight of 5 kilogrammes is attached to free end of wire. The resistance of this stretched wire was measured by the potentiometer as in the previous case.

Results are tabulated as below :

No.	Name of elements	Resistance of Wire		$\rho = \frac{R}{R_1}$	Calculated σ
		loaded = R_1	unloaded = R		
(1)	Ag (Silver)	2·850 Ω	1·054 Ω	·37	·37
(2)	Pt (Platinum)	1·799 Ω	·7006 Ω	·39	·39
(3)	Al (Aluminium)	·5792 Ω	·1911 Ω	·33	·33
(4)	Cu (Copper)	·3115 Ω	·1132 Ω	·364	·364
(5)	Fe (Iron)	5·247 Ω	·8919 Ω	·17	·17

Discussions :

Slight variation was observed in the values of ρ (observed) and ρ (calculated). These variation occurs in fifth places of decimal only. The observed values are slightly less, as we have neglected $(\delta S)^2$ in equation No. 6. The load used for stretching the wire is 5 Kgs only, because Poisson's ratio holds good only when longitudinal strain is small.

MECHANISED FISHING IN TAMIL NADU—A REVIEW

By

S. KESAVAN, L. M. E., A. M. I. S. E.

Works Manager, Agricultural Refinance Corporation,

Schemes (Fisheries) Tuticorin - 1

Introduction

Tamil Nadu is one of the leading maritime States in the Republic of India with a well developed and organised Department exclusively for Fisheries Development, the principal aim being to increase the catches by improved fishing methods and to explore more extensive fishing grounds. Tamil Nadu has a very vast coast line for exploitation of fishery potentials.

Fishing boats constitute one of the largest capital investments in the Fishing Industry. Experts in this field do not have a second opinion to improve the lots of fishermen through mechanisation and modernisation of fishing crafts. Appropriately enough the scheme of mechanisation of fishing crafts has been accorded top priority in the schemes formulated by the Fisheries Department in Tamil Nadu.

Mechanisation

Mechanisation of Fishing boats has been undertaken in stages in Tamil Nadu by —

1. Improving the indigenous crafts for mechanisation.
2. Introducing small mechanised open fishing boats and
3. Constructing larger decked fishing boats.

With the assignment of experts from the Food and Agriculture Organisation of the United Nation, the mechanisation scheme took a leap forward. Two 22 feet Danish built boats from F.A.O. for operation in Tamil Nadu coast under the guidance of Mr. Illugason, the Fishery Engineer, F.A.O. proved to be more efficient than the local boats. These boats became popular among the local fishermen and there has been demand for more boats of that type since then.

Thus to meet the demands of the fisherfolks in Tamil Nadu, construction and supply of mechanised fishing boats were taken up at the end of the first Five-year Plan with technical knowhow from experts of F. A. O. like Mr. Paul Ziener and Mr. Peter Gurner, Naval Architects.

The Tamil Nadu Fisheries Department which started the construction of fishing vessel on a small scale has extended its activities in this field on a very large scale and now has 4 boat building yards equipped with all labour saving mechanical and electrical equipments and well trained men

to construct boats ranging from 15 footer to 50 footer. In addition to the 4 Boat Building Yards, constructing only wooden fishing vessels, the Tamil Nadu Fisheries Department has set up a Research-cum-Boat Yard for the construction of Ferro-cement Boats.

Materials for the construction of fishing boats

As about the materials used for the construction, wood is one of the most durable of the natural raw materials and as such it is extensively used for the construction of modern fishing crafts. Some of the species now being used in Boat Building are Teak (Tectona grandis), Aini (Autocarpus hirsuta), Venteak (Lagerstroemia lanceolata) in view of their elasticity ability to withstand the constant immersion in salt water, weight, strength, bending properties etc. Now it is feared that wood suitable for boat-building may be scarce in course of time and as such our department thought it fit to introduce substitute materials like Ferro-Cement. In fact the Tamil Nadu Fisheries Department is very proud of having constructed the first ever largest 38 ft. Ferro-cement boat in India and launched her successfully for fishing operations.

In wooden vessels the fastening materials will be copper and brass for portions which are always kept constantly immersed in sea water and C. I. material above water level. The area bellow the designed water level of wooden hulls of the boats are always sheathed with either copper, aluminium alloy sheets or fibre-glass reinforced plastics to make the fishing boats free from marine borer attack in trophical waters and the under water sheathing is coated with anti-corrosive and anti-fouling paints to make the sheathing materials impervious to marine corrosion and fouling organisms sticking to the hull. The portions above the water-level is coated with ready mixed white paints as a preservative and painting of the fishing vessels gives good appearance also. The fishing vessels are propelled by high-powered Marine Diesel engines, the horse power ranging from 30 to 85.

In conclusion, the Tamil Nadu Government is to-day occupying a prestigeous place in building boats for the development of the fishing industry and simultaneously pursuing actively vaious means for the introduction of newer materials for the benefit of the boat building industry.

CLASSIFIED REGISTRY OF I S E MEMBERS

It has been decided to prepare a Registry of Members in all grades Classified according to Sates they belong to and specially, to the Division of Engineering of their respective proficiency, like Civil, Electrical, Mechanical, Chemical, Mining, Electronics, Tele-Communication, Industrial, Naval, Architecture etc. Members are therefore requested to intimate to the Office of the Society, the Division they wish to be listed under as also their service / business and postal address in full for the purpose.

MODELS

By

Prof. GEORGE ALEXANDER, B.Sc., B.E. M.Sc. (Eng'g.), F.I.E., M.I.S.E.
Professor of Civil Engineering
And
K. ACHUTHAN, B.E. (Hons.), M. Sc. (Engg.), Mem. I.G.S.,
Mem. C.S.I. (Non-Member)
Reader in Civil Engineering, Annamalai University,
Annamalainagar, Tamil Nadu

INTRODUCTION

The word model as generally used in scientific work connotes a miniature replica of a device used for the demonstration of ideas and methods. The making of mdoels is one of the oldest pursuits of mankind. In fact, the Egyptians believed that the human spirit, after death, was capable of travelling on land, but required assistance across the waters of the Nile. Consequently, among the objects they buried with their dead was a model boat, called a "Spirit Ship", to assist the soul across the river.

CLASSIFICATION OF MODELS :

(1) Iconic Models

(2) Analogue

(3) Symbolic Models.

(1) ICONIC MODELS

An iconic model "looks like" what it represents. Many photographs, painting, and sculptures are iconic models of persons, objects, or scenes. The toy automobilies an iconic model of a "real" automobile. A globe is an iconic model of he earth.

Iconic models are particularly well suit for describing either static or dynar things at a specific moment of time. F example, a photograph or a flow plan c provide a good "picture" of the pla But iconic models are generally difficult use to represent dynamic situations, su as the operations of a factory. For th reason they are not well adopted for u in studying the effect of changes in process or system.

(2) ANALOGUES

In constructing a model of most objec events, processes or system, it is not alwa convenient to reproduce all the pertine properties even if they are scaled down up. For example, we cannot convenient reproduce the geological structure of th earth in a globe. But we can easily re present various types of geological forma tions by different colours. If we do so we are making a convenient substitutio of one property (colour) for another (geo logical structure) according to some tran formation rules. In maps, for exampl where such transformations are commor

the rules for so doing are usually given in the legend, the map's legend may tell that a solid line represents a hard surfaced road or that a broken line represents an improved road. To the extent that a model represents one set of properties by another set of properties, that model is an analogue.

Graphs are very simple analogues. In graphs we use distance to represent such properties as time, number, percent, age, weight, and many other properties.

A graph, like other analogues, is frequently well suited for representing quantitative relationships between properties of classes of things. Graphs enable us to predict how a change in one property will affect another property.

By transforming properties into analogous properties we can frequently increase our ability to make changes. Usually it is simpler to change an analogue than to change an iconic model, and compared with iconic models, not as many changes are generally required to get the same results. For example, contour lines on a map are an analogue model of the rise and full of the terrain. It is easier to change the contour lines of a 2-dimensional map than to change the relief (iconic-model) on a 3-dimensional one.

The analogue is successful in representing dynamic situations, that is, processes or systems.

(3) SYMBOLIC MODELS

In a symbolic model, the components of what is represented and their interrelationship are given by symbols. The sysmbols employed are generally mathematical or logical in chacter.

A mathematical model of a system consists of a set of equations whose solution explains or predicts changes in the state of the system. Mathematical models are highly abstract. Yet it is abstraction that makes mathematical models general, subject to manipulation.

MODEL BUILDING

During the process of model building, the model builder is continually faced with a decision concerning simplicity versus completeness in the model. The simpler the model is, the easier it is to understand and use and probably the cheaper it is to use. However no important element of the system which bears on the process to be modeled should be omitted from the model. For example the use of hydraulic equations is familiar to most hydrologists. Because the general form of the equations is difficult to solve, simplifiications are made. Each simplification requires a statement of an assumption, such as that steady uniform flow occurs in a trapezoidal channel. Once these assumptions are made the problem is reduced to a manageable size and can be solved, but the solution does not apply if the assumptions are violated.

Any model must be easily usable and must give satisfactory results. While a model builder is concerned with how a model is derived, a user is more concerned with what is derived and how well it can predict results for his particular problem.

CONCLUSION

No handbook can do our thinking for us. Handbooks are a concise presentation of methods and techniques that have been

most useful in the past. A successful handbook will soon outmode itself by the progress it engenders. In a handbook, techniques are illustrated for a given situation often independent of another phenomenon.

In research we must interpret and express each phenomenon in the context of chronologicol sequences of the real world ; in other words, models must be sequential in time and space.

Irwin D. J. Bross expressed his sentiments on models very concisely,

"A big advantage of a model is that it provides a frame of reference for consideration of the problem. This is often an advantage even if the preliminary model does not lead to successful prediction. The model may suggest informational gaps which are immediately apparent and consequently may suggest frutiful lines for action. When the model is tested, the character of the failure may sometimes provide a clue to the deficiencies of the model. Some of the greatest scientific advances have been produced by failure of a model.

In Living Memory

DYUTH KUMAR DAS, A.M.I.S.E.

Text of Condolence Resolution moved from Chair and adopted at the meeting of the ISE Executive Committee on November 30, 1973 with observation of one-minute silence in memory of the departed Soul :

This meeting of the Executive Committee of India Society of Engineers records with deep sense of sorrow and grief the sudden and premature demise of Shri Dyuth Kumar Das, A.M.I.S.E., of Hamburg, West Germany at the age of only 43.

The meeting proudly recalls the active and worthy association he had been maintaining with the Society since his enrolment in April 1970, by correspondence, also by frequent contribution of articles for the Society Journal "Science & Engineering". His ready response to the Society's appeal for contribution of funds in support of the struggle for liberation of Bangla Desh in 1971-72, is also remembered on this occasion with high appreciation.

May his Soul rest in peace !

SOCIETY NOTES

NEW MEMBERS

Admitted on 25th May, 1973.

Members :

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Power House Compound,
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SCIENCE & ENGINEERING

Volume XXVI No. 11 December 1973

A NEW TOWN IN A METROPOLITAN MASTER PLAN

When a New Town is conceived in a Metropolitan Master Plan, the intention can be reflected in an awareness that the geographical sector corresponds to a line of demographic expansion of considerable scope, for which urban facilities still fall far short of requirements of thousands of new inhabitants that start moving into the Metropolitan area in search of employment and urban comfort. This also means creation of a distant suburb into a new town.

Town planning studies can quickly set a perimeter of communes of specific developmental areas lying between valleys and rivers. In the Calcutta Metropolitan area the total perimeter extends from Bansberia — Kalyani on the North to Uluberia — Sonarpur on the South, the outer extremities of Salt lake areas on the East, and Western areas of Howrah perimeter on the West.

In designing new Towns within the Metropolitan perimeter, roads and public transport lines already in existence or to be provided should at all points within the New Town design perimeter be less than twenty minutes away by car or bus from the New Town centres. The total area of all the perimeters of the new towns can be equal to the area covered by the Metropolitan City perimeter, but the new towns should ordinarily be separated from each other by stretches of green areas.

Of course the purpose of a New Town or as now a days popularly, called 'Satellite' for a Metropolitan City, is to set up regional urban centres on the new developmental area within the Metropolitan perimeter, and blend the same with architectural ensemble of new type so as to serve upto designed demographic capacity covering a minimum of twenty-five years ahead. The object further includes the idea of strengthening the urban infrastructure that is indispensible to operation of a large built-up area, creation of a large labour market, and free choice for place of work ; and to provide for mobility of the inhabitants both towards Metropolitan City centre and within the New Town perimeter, and also from one New Town to another new town or satellite township.

The design for the new townships or Satellites should cover the design and construction on a turn-key basis, for all the services and thoroughfare facilities, houses, schools, public and private facilities district wise.

The building facilities should control the variety of architecture and integrate the architectural totality of effect on the eye and mind.

The public facilities should cover the qualities of boulevards, squares, fountains, pools, decorated round abouts, public lavatories, public gardens, streets and parks, parking facilities and public markets and super markets.

The dominant objective to reach in creation of a New Town should be to create a specific desired approach to the town development, together with a striving to improve the standard of the living environment, create a pole of attraction due to the multiplicity of facilities offered in the new town, a place for informal encounters and a place combining production, information, relaxation, creativity, leisure, and consumption, youth and social centres suited to every age group and cultural level of the population.

The New Town public facilities can also include specific facilities like departmental youth centre, combining sporting hall, and variety theatre with 1500 tiered seats, 600 seats theatre, swimming pool, shopping centres, centre for pedagogical documentation, school, career guidance service, bureaus for departmental associations, nursery, social services etc. These can be supplemented by private facilities like shops, offices, cinemas, chemists' drug stores, panoramic restaurants, library and reading room, cultural halls, sports halls, and variety of evening leisure spots.

The elements of information can be made to include welcome services, hostess kiosks, display boards, information banks or centres, television screens, exhibition halls, music halls etc.

The developments that are being undertaken by CMDA in Greater Calcutta area, the Asansol — Durgapur complex, the Gauhati — Bongaigon complex, the Madras — Adair complex, the Bombay — Poona complex, the Delhi — Faridabad complex, the Hyderabad — Secunderabad complex, the Bangalore — Tumsar complex, the Bhopal Ujjain complex, the Chandigarh complex can take all these factors into account in the development of New Towns or suburban satellite towns.

An important consideration in such Metropolitan development is the correct composition required for the advisory committee of the implementing body. While no doubt there should be representation from the concerned municipalities looking to their civic interest, from the political parties looking to the politico-economic view points, from the Press for information and working up enthusiasm for the projects, from the already existing Improvement Trusts (if any), from Port authorities (if any), from the Town & Country Planning Department of the Government concerned in selecting this board of advisers, it is often forgotten that Planning Engineers in the consultancy profession particularly those connected with and having deep insight into industry, town planning, housing and architecture need to be on the advisory board, as their services in respect of proper techno-economical housing and planning advices are of supreme importance to the implementing body. We wonder if the CMDA and such bodies in India have any such advisers on their long lists of advisers packed with non-technical people, many of whom have the remotest idea on town planning.

PLANNING BY NETWORK ANNALYSIS

By

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INTRODUCTION

Strategy of Network analysis is an effective tool in the hands of management for planning, scheduling and controlling of a large and complex project for optimum utilisation of men, money, machine and material at all management level.

There are different strategies of Network, namely CPM (Critical Path Method), PERT (Programme Evaluation and Review Technique), RAMPS (Resource Allocation and Multi-Project Scheduling) etc., where the approaches in analysing technique are different but the objective of Network analysis for management and planning purposes are same, i.e., control of activities, resource allocation, re-allocation, man-machine utilization and cost optimization. This paper describes the Critical Path Method of Network analysis.

ANALYSIS AND SCHEDULING

Let us consider a building project upto the lintel level for the network analysis. For this purpose first the Work-Break Down (WBS) Schedule is to be prepared. The WBS with the Schedule date of completion are taken as follows :—

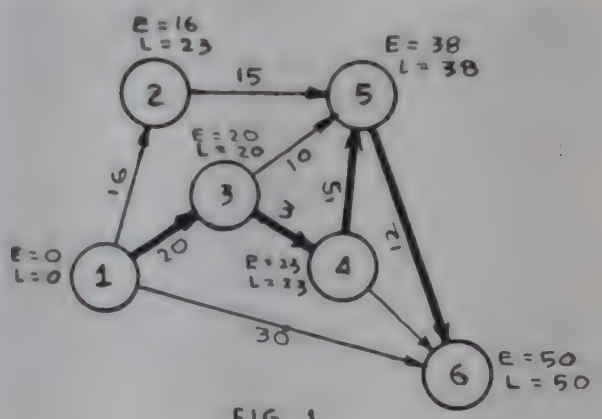

FIG 1

Activity.	Work Content	No. of days reqd
1.	Foundation.	20
2.	Frames for doors and windows	16
3.	Grills	15
4.	D.P.C.	3
5.	Superstructure	15
6.	Earthfilling	10
7.	Concreting for stair	16
8.	Lintel	12
9.	Collection of materials	30

This schedule can be prepared in a much more elaborate form than the present one as considered. For example work content Foundation can be further Sub-divided into Survey of Site, Soil Testing, Opening, of Trenches, Pouring Concrete etc.

In order to prepare the Network of activities, it is essential to determine the extent of interdependency of events involving work elements and the quantum of individual activity.

Generally events are represented by Circles called 'Nodes' describe start or completion of tasks, and activities are denoted by arrows. Correct numbering of the events can be done by applying Fulkerson's rule. The Network diagram of the above work contents is shown in Fig. 1.

CRITICAL PATH ANALYSIS

Begining at the initial event, event 1 is at zero time. The earliest time (E) the event 2 can be completed is 16 days. Event 5 is connected by three paths. These paths are 1 - 2 - 5, 1 - 3 - 5 and 1 - 3 - 4 - 5. The total durations are calculated and shown below :

Path	Total time
1 - 2 - 5	16 + 15 = 31
1 - 3 - 5	20 + 10 = 30
1 - 3 - 4 - 5	20 + 3 + 15 = 38

Hence the earliest time (E) in which the event 5 can be completed is 38 days (i.e., the time taken by the largest route.) Earliest occurrence time of all the other events are calculated in the same technique which is known as "Forward Pass Method" and are shown in Table 1 below :

Earliest Event Times (E)

Event	Earliest time
1	0
2	16
3	20
4	23
5	38
6	50

The latest possible occurrence time (L) is calculated by means of "Backward pass method". Begining is made from the Last event, the earliest time being known, the latest possible occurrence time is calculated by subtracting the duration time. Hence, L for event 5 is 50 - 12 = 38 days. Again event 4 is connected by two paths, these are 6 - 5 - 4 and 6 - 4. L for these paths are :

Path	L, days
6 - 5 - 4	50 - 12 - 15 = 23
6 - 4	50 - 16 = 34

Without upsetting the total project time, it is essential that the event 4 must begin at latest at 23rd day. Hence L for event

4 is 23. L for all other events are calculated and shown in Table 2 below :

Latest occurrence times (L)

Event	L
1	0
2	23
3	20
4	23
5	38
6	50

In a critical path E and L values of tail and head events of all activities laying in the path are same i.e. E - L = O or E = L. In the example under review it is observed

$E_3 - E_1 = 20 = T_{1-3} = L_3 - L_1$

$E_4 - E_3 = 3 = T_{3-4} = L_4 - L_3$

$E_5 - E_4 = 15 = T_{4-5} = L_5 - L_4$

$E_6 - E_5 = 12 = T_{5-6} = L_6 - L_5$

At the other points on the network E = L. Hence the path connected by the nodes 1 - 3 - 4 - 5 - 6 is the critical path of the network and is shown by thick lines.

INTER – RELATIONSHIP BETWEEN EVENT TIMES AND ACTIVITY TIMES

From the above values it is clear that

E_{1-3} | START $= E_1$

L_{1-3} | COMPLETE $= L_3$

E_{1-3} | COMPLETE $= E_1 + T_{1-3}$

L_{1-3} | START $= L_3 - T_{1-3}$

Generalising :

$L_i = L_j\ T_{i-j}$ and $E_j\ E_{-i} + T_{i-j}$,

Where, L_i = the Latest possible start time

L_j = the Latest possible completing time

T_{i-j} = duration time of activity

E_i = Earliest possible start time

E_j = Earliest possible completing time

Once the E and L values are known Slacks, and Floats of an activity can be easily found out. For an activity, Tail Slack (T.S.)= $L_i - E_i$, Head Slack (H.S.) = $L_j - E_j$ Total Float (T.E.) = Maximum duration time - duration time = $(L_j - E_i) - T_{i-j}$

Free Float (F.F.) = T.F. - H.S. and Independent Float = F.F. - T.S.

When all the above values for each activity is known planning for effective targets, prediction of probable performance time by the plan and improvement in the plan in time if the performance is less than the target can be done easily.

CONCLUSION

The CPM analysis of network is now widely used by the industries and this can also be used for Research, Design, Development, Construction, Installation and many other Projects.

REFERENCE

1. Prof Dr. A Bhattacharyya, Management by Network Analysis, Published by the Institution of Engineers (India).

SEVENTH INTERNATIONAL PIPELINE ENGINEERING CONVENTION

LONDON — JUNE 1973

Reported by

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This year the above convention and exhibition was held at Earls Court, London, England. The convention was well represented by different countries, both from Eastern and Western hemispheres. The pipeline convention and exhibition were coordinated with International Marine Exhibition, Effluent and Water Treatment Exhibition and Environmental Pollution Control Exhibition. This coordination provided a broader scope and apprehension in terms of Pipeline Technology in proper perspective.

Engineering Convention

In total five conventions were held. The representatives from different countries put forth the engineering problems in light of the totality of the Technology. The subjects that were discussed in the Conventions were :

1. North Sea Deepwater Pipeline Construction Equipment and Methods.
2. Central Europe Pipeline System (CEPS).
3. Long Distance Transportation of Municipal Solid Waste.
4. Practical Aspects and Results of Automatic Welding as applied on Natural Gas Transmission Lines in Netherlands.
5. Forum discussion on "New Steels for Pipelines".

(1) As regards to North Sea Pipeline, BP has awarded the Contract to Brown Root Ltd., and to Saipem of ENI group. Brown Root in a U.S. Company and Saipem is owned by Govt. of Italy. Brown Root has a world wide reputation in offshore laying of pipelines and Saipem has a vast world wide experience in Pipeline laying and in fact Saipem had been a pipeline contractor in the past for the writer. The length of the line is about 110 miles, from BP's offshore rigs in the area of "Forties field" in the North Sea. The main line is 32″ dia. grade API. 5LX-65, w.t. 0 75″, with reinforced steel concrete coating of 2″. Gathering lines from different offshore rigs. have nearly been completed and connected to a "Header" from where the mainline will originate. The pipelaying barges of Brown Root and Saipem are built to cope with the rough and deep

North Sea (about 500') operations. There are many areas of construction problems that are yet to be ironed out and will be sorted out as and when occasion arises, and this calls for a team of experienced crews, Technologists and Engineers and Brown Root and Saipem, do have them.

(2) Because of strategic limitations, the discussion on "Central Europe Pipeline System" (CEPS), was limited to generalities of the technology. However, it was clearly pointed out that this pipeline also supplies the requirement of NATO, besides the usual consumer. A discussion generated from the delegates about the implications of NATO, with this pipeline. It was pointed out on this subject, that there are many terminals connected to this pipeline which are for military uses and the location and design of these terminals have been done accordingly. To mention the salient features of such installations, two main factors are taken into considerations :

a. Locations should be in areas where the topography can cover up any such installations.

b. To make it shatter proof the storage terminals are located below the ground level, with shatter proof design and construction.

CEPS, has network in the countries, that are in NATO alliance. This system is operated by Central Europe Operating Agency (CEOA), with its headquarters at Versailles.

(3) "Long distance Transportation of Municipal Solid Waste"—Seminar on this subject was held with a joint session with the "Pollution Control Congress". Discussions on this subject were very academic and specific with particular reference to a proposed 40 mile pipeline from Hendon to Stewartby, England. The speakers, suggested a particle size 4" below packed into 6" dia. Capsule, to be carried with water. The speakers also suggested a return water pipeline along with the main pipeline.

To many delegates, the technical parameters and economics indicated by the speakers seemed very inconsistent and a debate originated and the session ended with many inconsistencies unanswered. As it seemed to me, the topics the speakers were at, is "Capsule Pipeline" but not "Solids Pipeline" in conventional approach. And this ambiquity of the subject should have been clarified by the speakers in total concept of Solids Pipelining.

(4) "Practical Aspects and results of Automatic Welding as applied on Natural Gas Transmission Lines in Netherlands" —

The automatic welding of large diameter pipeline is a relatively new technique. The introduction of automatic welding in this line resulted into various problems. Among the many defficiencies encountered initially, following are worth mentioning :

a. Non-uniformity of different passes.

b. Non-uniform "Hardness factor".

c. Gaspockets, slags, impurities in the weld.

d. High percentage of rejection, as high as 12%.

e. Non-flexibility of the equipment to cope with the needs of the job.

f. Non-adaptability of the automatic equipment in humid weather conditions.

However, on a forum discussion it was pointed out that although problems were there initially, but most of the problems were sorted out as and when the operators of the "Automatic Welding Machine" got experience on the job. It was also mentioned that automatic welding is more suitable to "yard jointing" than "on line".

(5) Forum discussion — "New Steel for Pipelines" :—

A general discussion was held on this subject and International Nickel of Canada presented a new kind of steel on the making by INCO. On the question of cost it was mentioned that this steel will be comparatively costly, but with heavy demands, the price will level off in due course.

Exhibition

Since the Pipeline Exhibition was co-ordinated with Marine Exhibition and Pollution abatement exhibition, there were various types of equipment on display. Of worth mentioning was the "remote controlled in line travelling welding radiographic unit developed by Saipem". However, this equipment has also been developed in U.S. and has been in use on line.

On the whole, to update myself with new developments and thinking in the industry, it has been a worthwhile occasion to attend the conference and exhibitions.

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Admitted on 26th October, 1973.

Members :

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